PUBLIC WORKS

A ug.

First Installment SOIL ENGINEERING

etting Ready for Winter: Five Notable Articles

olving Industrial Waste
Disposal Problems

Ising Refractors Effectively in Street Lighting

ortable Shelters Permit Winter Concreting

•2 Factors to Consider in Planning Incineration

verial Photography Pays
off in Highway Work



J. C. Boyd, County Engineer, has been with Palm Beach County, Fla., since 1926, except for time out in military service. More on page 28.

After 17 years of severe service
POZZOLITH CONCRETE in good condition

rentiald, Ohio Sewage Treatment Place exactly Concrete throughout New shoots on our Issuedigtely below plow readilion or higgesty tedays, Consulting Engineer

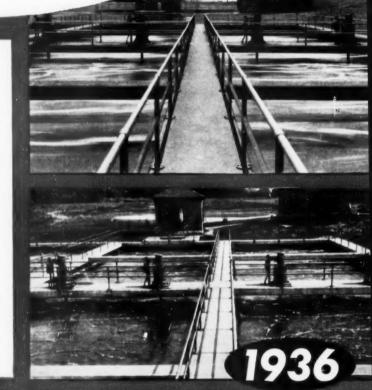
1953

At the time of a recent inspection of the Mansfield Sewage Treatment Plant, now in service 17 years, the concrete was found to be in good condition.

Pozzolith produces durability like this in sewage treatment plants — one of the most severe exposures to which concrete is subjected — because it disperses cement, reduces water, entrains the optimum amount of air and conforms with the water-cement ratio law.

Pozzolith also provides important construction advantages for this type of concrete work. Among these advantages are easy placeability for thin wall sections, low shrinkage and no segregation.

Investigate the advantages of Pozzolith for your next job . . . it will enable you to obtain the required qualities at lower cost than by any other means. "See-for-yourself" Pozzolith demonstration Kit supplied on request . . . without cost or obligation.



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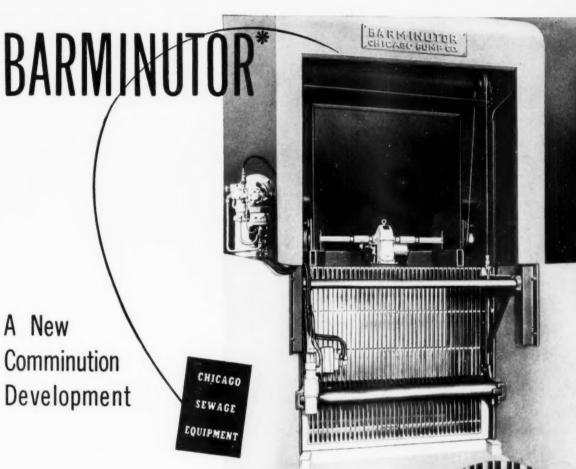


RUIII DERS

CLEVELAND & OHIO

Subsidiary of American-Marietta Company

TORONTO, ONTARIO



The Barminutor Model "A" exclusively pravides the advantages of comminution with maximum economy for flows from 10 to 15 M.G.D. Screening and cutting of coarse sewage material is accomplished without removal from the flow, maintaining continuous cleaning of the screen. The Barminutor, developed and tested over five years, based on fifteen years successful experience with the Comminutor, eliminates odors and handling nuisance in the screening process. High rate cutting in the flow—comminution—provides low maintenance cost and long life for cutting and the screening process.

In tests conducted on a Barminutor installed at the Indianapolis, Indiana Sewage Treatment Plant, the unit was subjected to test loads of screenings up to six times normal load for 40 M.G.D. This material was comminuted and the screen completely cleaned in six minutes. Even with this heavy load head loss through the screen did not exceed 6". Like the Comminutor, power requirements are low.

Barminutor installed in 5' channel.

FUNCTION OF THE BARMINUTOR

- 1. Cleaning the ¾" vertical bar screen and cutting of the screenings is accomplished by continual travel of the comminuting unit at 8 ft. per minute. Both upward and downward travel is controlled by an electric reversing brake motor.
- The cutters on the comminuting unit, rotating at 400 R.P.M., travel within slots of the U-shaped bars and carry coarse material to the combs for cutting.
- 3. The direction of rotation automatically reverses when the direction of travel changes. The combs automatically position themselves to accomplish rapid cutting for each direction of rotation.
- 4. Uncuttable material is automatically rejected without damage to the cutting parts.
- S. Rotation of cutters, position of combs and rejection of uncuttable material is accomplished through oil powered hydraulic system.



Close-up of Cutters and Combs. Cutters

*Chicago Pump Company's trade name tor its new screaning and comminuting device for large sewage flows from 10

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY

Flush Kleen, Scru-Peller, Plunger. Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.



CHICAGO 14, ILLINGIS

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



PONTIAC'S
GARBAGE PROBLEM

This sanitary landfill is being built on the site of an old-fashioned, unwholesome open garbage dump in the progressive city of Pontiac, Ill. A Caterpillar HT4 Shovel spreads and compacts the old garbage, covers it with clean earth, and then compacts a solid surface for future development.

Pontiac chose the Caterpillar HT4 Shovel in the illustration only after thorough investigation. "My committee decided that the HT4 would handle our landfill project more efficiently than any similar equipment we studied," states Alderman J. A. Rennie, chairman of a committee appointed by Pontiac's mayor especially to learn about modern garbage disposal methods.

The bucket of the HT4 handles a lot of material fast, due to its 1½-yard capacity and hydraulic controls which enable raising and dumping of the load simultaneously. Because of rugged construction, this machine can withstand extreme stresses and stay on

the job year after year. The versatile unit can earn its keep at many other tasks as well: grading, excavating, handling bulk materials, snow removal, construction work and repair of city streets.

Your Caterpillar Dealer—who gives skilled service on all the equipment he sells—will gladly demonstrate the Cat* HT4 Shovel. Ask him to prove that this hard-working, long-wearing machine is a wise investment for your community.

Caterpillar Tractor Co., Peoria, Illinois

CATERPILLAR*

NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE

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CONTENTS FOR AUGUST, 1953

Cotting Boards for Winter		71								
How We Get Florida Streets in	Winter B. F. J. F. H.	71 72								
Winter Maintenance in New Hampshire.										
Snow and Ice Removal in Upstate New York. By F. Ray Williams 7 Solving Industrial Waste Disposal Problems in South Dakota.										
By R. J. Staph and C. E. Carl										
Tarboro Cuts Power Costs by Using Heavy Fuel Oil. By R. M. Weatherby										
Portland Builds a New Pipe Line. By Guy Browning Arthur										
The Use of Refractors in Street Lighting.										
Aerial Photography Pays Off in Maryland. By William F. Childs, Jr										
Siphons Carry Sewage Under Expressways. By D. W. Johnson										
County Tax Structure Clarified by Public Relations. By Pat Thomson										
Portable Shelters Permit Winter Reservoir Construction.										
How New Pumps Cut Water Plan	t Power Costs. By Ray G. Vollendorf	89								
12 Factors to Consider in Planni	ng for Incineration. By A. E. Stilson	91								
What You Should Know About Sc	oil Engineering. By Leo J. Ritter	94								
Moving Baffles in Sedimentation T	anks. By F. E. Daniels	104								
Equipment Reduces Cost of Septic Tank Installation.										
Sewer Maintenance: Sewers are Full of Surprises. By Robert Poss 1										
New Drilling Device Speeds Stump Removal.										
Results From Twelve Year Old Sewage Plant.										
Keeping Traffic Moving During Construction. By E. R. Leiser										
TI - 14/ 14/ 1- Di		100								
9										
	st									
The Sewerage and Refuse Diges	t	137								
The Editor's Page	7 Books in Brief	56								
	4 Public Works Engrg. Notes									
	8 APWA News	105								
	2 Washington News	108								
	28 Lighting and Traffic Control									
	New Public Works Equipment	148								
and	- Land Trains Equipment	140								
Worth Telling. By Arthur K. Aker	rs	154								

The 1953 volume of Public Works will be available on microfilm through University
Microfilm, 313 N. First St., Ann Arbor, Mich.

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

Test Rubber Roads in YOUR COMMUNITY To S-T-R-E-T-C-H Your Highway Dollars

Natural Rubber Roads . . . Newest Highway Advance

Laboratory tests to date indicate that natural rubber powder added to ordinary asphalt paving mix will build roads that last longer, require less repair, and are less costly in the long run. When proven, this means savings of millions of dollars for the taxpayer. Natural rubber-asphalt test roads have already been laid in nineteen states in the U. S. and in several provinces of Canada.

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\$500 for the average block. For complete information that will tell you how to Pave-A-Block and test rubber roads in your community, just mail the coupon.

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NAME

CITY____STATE___

THE EDITOR'S POINT OF VIEW



Scil Engineering and Its Application to Public Works Construction

FOR any engineering project, the cheapest material is normally that which is available locally. provided we know how to use it effectively. In publishing a series of articles on the basic elements of soil engineering, this magazine aims to extend greatly the knowledge concerning this important field of work. The principles of soil engineering do not apply solely to highways, streets and airports; they are equally useful and applicable in designing and building all sorts of structures. We will later publish articles showing how soil engineering knowledge aids in designing structures for sewage and water treatment plants, for sewer lines and water mains, and for other public works projects. The value of such knowledge in these various fields is obvious; and we believe that usable data along these lines will fill a long-felt need.

Good Sense and Good Engineering for Flood Control

RECOMMENDATIONS of a special board of engineers to review the problem of preventing flood damage along the Kansas River make good sense and good engineering. The report rejects the program proposed by the Corps of Engineers for flood control by a multiplicity of headwater reservoirs, pointing out that such reservoirs would be difficult to operate, would cost excessively and would not reduce flood peaks in critical urban areas sufficiently to prevent serious and costly damage. There would be required for reservoir basins 450,000 acres of valley land, half as much as the area that was flooded in 1951; and the cost of protecting the rural areas in the flood plain would exceed \$700 per acre of land benefited-twice the present value.

The solution recommended is to provide adequate waterways through such urban areas as Kansas City, Lawrence, Manhattan and other valley cities. Encroachment on the river channel has been general along the Kansas, just as it has along every other river. Floodways to carry peak flows are recommended, with widening of stream channels, flood walls and levees, and restrictions on occupancy and use of flood plain areas. The cost of this program is about one-fourth that proposed by the Corps of Engineers for reservoir construction, aggregating some two hundred mil-

lion dollars against more than eight hundred million for reservoirs. Moreover, the reservoir construction program will not reach its maximum effectiveness, whatever that may be, for an unknown number of years, depending on the approval of appropriations by Congress, whereas the construction of the proposed floodways can be completed in a relatively short time.

We congratulate the special board of engineers, Abel Wolman, N. T. Veatch and Louis Howson, on an unusually sound and interesting report.

Highway Accidents Happen All the Time— Not only on Holidays

EVERY week-end, and especially on such holiday week-ends as the Fourth of July, we hear a good deal about the highway accident toll; but we should not let these dramatic happenings obscure the fact that the daily average of highway fatalities is almost incredibly bad. Prof. Ben Petty has pointed out that, with some 38,000 fatalities a year, the daily average is about 104; and over a long week-end, we should expect, just as an average, something like 300 deaths.

What we need is more and better highways, designed and built for modern traffic conditions—plus a degree of control of our drivers that will reduce the accident rate. And since we can't have a traffic policeman on duty at every cross-roads in the nation, it looks to us as though we need more and better mechanical devices for the safer handling of traffic. Just as in every other phase of public works, the time is past when everything can be done by hand. Ingenuity must devise better methods for the control of traffic without greater manpower requirements. And, in the meantime, we ought to start building adequate roads.

Applying the Principles of 3-D to Engineering

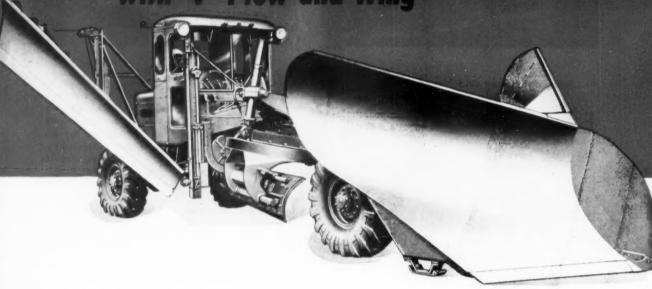
THE newest thing in the entertainment field is the three-dimensional motion picture—creating the illusion of depth by the use of two-colored tinted glasses and offset colored projections.

Engineering practice, too, has been defined as three-dimensional. First there are the technical categories, the "know-how". Then comes production, getting the job done. And finally, there is necessity for administration and supervision of

(Please turn to page 64)

B-R-E-A-KTHAT

" Plow and Wing





Opening a road through deep, hard-packed snow.



Steadily punching a way through ice-crusted snow.

The tremendous power and directional control of Austin-Western's Four-Wheel Drive and Four-Wheel Steer Power Graders are supremely important in plowing snow. Only a grader with traction at both ends can resist the side thrust developed in handling heavy drifts. In breaking a road open, and particularly in widening out, power on the front wheels keeps the plow steadily going through without slipping or sliding. Rear steer counteracts side draft and adds the maneuverability so essential where the "going is toughest." Whether the snow is deep or shallow, light or heavy-any Austin-Western Grader equipped with a Giant Plow and Wing does a real job of fighting it.



Rear steer is a great help in widening out.

n-Wes

Power Graders

Road Rollers Motor Sweepers Construction Equipment Division



Manufactured by

AUSTIN-WESTERN COMPANY

Subsidiary of Baldwin-Lima-Hamilton Corporation

AURORA, ILLINOIS, U.S.A.



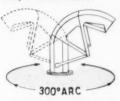
No matter what the snow problem, this combination is "tailor-made" for the job. City streets, trunk highways, farm-to-market roads can be opened and kept open with this out-fit. The Sicard Snow Master handles any snow easily and accurately, either blowing it clear of the road, or loading it into trucks. With the power and control of Four-Wheel Drive and Steer, an Austin-Western Grader will take the rotary where it's needed in the shortest possible time and will keep it working in places inaccessible to ordinary machines. An Austin-Western Grader, plus a Snow Master . . . this is the "Powerhouse" combination—"Blockade Breaker" in the war with winter.



"Precision" loading from any angle is easy with the Sicard.



Chute telescopes for long or short range casting.



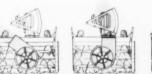
Chute rotates for casting or loading to either side.



Opening a road in the Rockies. Note the depth of the snow.



Snow is blown any distance from 3 ft. to more than 150 ft.



Blower Housing rotates. Casts to either side, or through chute.







Everyone on a water main turns a tap and expects water...

not excuses.

That's why so many municipal water pumping stations—in small and large communities—have an independent power source.

In addition to providing dependable power in this service, Fairbanks-Morse Diesel and Dual Fuel engines are reducing pumping costs—in some cases as much as 60%.

Direct drive... belt or geared drive... electric drive... F-M 2-cycle engines provide the flexibility to keep the pressure up under all extremes of operating conditions. And—produce impor-

tant savings in maintenance, operation and total cost per gallon pumped.

Write today for the engineering assistance of a Fairbanks-Morse municipal power specialist to help you select the right power and the right pump to fill your needs. Write to Fairbanks, Morse & Co., Chicago 5, Illinois.

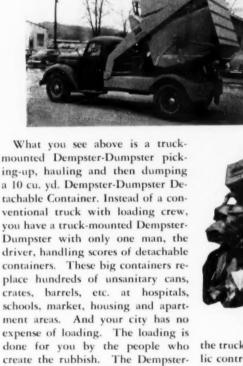


FAIRBANKS; MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES DIESEL LOCOMOTIVES - RAIL CARS ELECTRICAL MACHINERY - PUMPS SCALES - HOME WATER SERVICE EQUIPMENT - FARM MACHINERY MAGNETOS ONE Truck and Only ONE Man Handle 15 to 25 Loads

of Trash and Rubbish Like This Daily . . .



The Dempster-Dumpster is mounted on any make truck chassis of suitable size. One Dempster-Dumpster, operated by only one man,

Dumpster services the containers on

pre-arranged schedule-handling 15

to 25 daily, one after another, with

one man.

the truck driver, by means of hydraulic controls in cab, does the work of 3 to 5 conventional trucks and crews. This Dempster-Dumpster System eliminates trucks and crews standing idle . . . eliminates re-handling of trash and rubbish . . . increases efficiency and sanitation.

of suitable size. One Dempster-Dumpster, operated by only one man, Pensacola, Tuscaloosa and Lexington,

Ky. as well as large cities like Balismore, Richmond, New York and Pittsburgh have installed the Dempster-Dumpster System. This modern method is saving each thousands of dollars annually plus eliminating ratinfested, unsanitary conditions. Complete information may be obtained by writing direct to Dempster Brothers, Inc.—exclusive manufacturers.



DEMPSTER BROTHERS, 983 Dempster Bldg., Knoxville 17, Tennessee

Why research never says: "let well enough alone"

Anyone might fairly assume that cast iron pipe which has served, and is still serving, over 45 American cities for more than a century, is as efficient and economical as pressure pipe can possibly be. Our member Companies have not been content to rest on that assumption.

By continuous research and development, they have attained, in *modernized* cast iron pipe, greater toughness, strength and uniformity to a point resulting in still greater efficiency and economy.

Modernized cast iron pipe is centrifugally-cast.

Where needed and specified, it is lined with cement mortar centrifugally applied, resulting in a tuberculation-proof pipe with sustained carrying capacity and, therefore, reduced friction loss and pumping costs.

If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with modernized cast iron pipe with either mechanical or bell-and-spigot joints. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.



CAST (IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

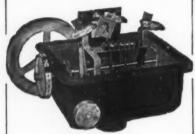
Modernized cast iron

It's a fact...our handy Readers' Service card is the way to get new catalogs.



pipe for Modern Waterworks Operation

ROTO-TROL



RF-2 with ALTO-TROL

Puts that second pump to work.

A 2-pump RF-2 ROTO-TROL with a built-in ALTO-TROL will operate each pump on alternate starting cycles, assuring equal use and wear of both pumps. Operates both pumps when required. Depth Indicator optional — extra.

Write for full data.

Water Level Controls Division

HEALY-RUFF Company

791 Hampden Ave., St. Paul 4, Minn.



Ideas and Events

People.



BY "DOC" SYMONS

H.T.M.A.—And I'm happy to say that my sojourn in the hispital the last half of June wasn't too bad. I got a new built-in girdle on the right side, lost five pounds, and had dozens of pictures taken of my innards from top to bottom. With new diets and more pictures in the fall I'm set for my second half century.—And—Thanks to all of you who wrote me in the hospital.



Let's get back to the AWWA Convention in Grand Rapids and a few things I won't forget.—A young fellow by the name of Lamb, one of Rolf Eliassen's students at M.I.T., made a bottom weary crowd sit up and applaud with enthusiasm for an outstanding presentation of a technical paper.—At the WSWMA Annual Luncheon, Col. "Bill" Rockwell, Asst. Secy. of Defense, and well known to water works men as head of Rockwell Mfg. Co., read a speech.
—I wish he could have talked off the cuff.

As I Heard It — For the ladies—all 365 of them—there were book reviews, a hat show and a trip to the Tulip Festival in Holland, Mich. The latter wasn't exactly 100 percent because of the fact that the buses deposited the ladies at souvenir stores and in mid-town for long periods of time: at least one bus didn't stop at the tulip farms at all, but whizzed right by because the driver "had to get back to G. R."

The book review was more successful and drew enthusiastic comment—r.nd what woman can resist enjoying a hat show. One of the models for the hats was Zita (Mrs. Ed) Alt of 'he Chicago Bridge and Iron Alts. Winner of the prize chapeau was Myra McDonald, of the Electro-Rustproofing's Frank McDonalds. Several of the ladies bought 'nats.—One I saw was purchased by Mrs. Bob Johnson (he of J. Stepher Watkins Engrs. in Lexington, Kv).

I don't know how Bob liked the hat (or the price), but the rest of us thought she looked real cute in it.



Seems as though everyone was there including a couple of boys (?) from Japan, but actually there were a number of absentees, including:

—Prof. Earnest Boyce of the Univ. of Mich., who was studying health problems in Java for WHO.

—C. C. (The Swede) Larson, Supt. of Purification at Springfield, Ill., who had just been made manager of the Springfield Sanitary District to succeed the late W. B. Walraven. —Ralph E. Fuhrman, who was busy in his new appointment as Deputy Lirector of Sanitary Engineering of the District of Columbia, under Dave Auld, who stepped up to fill the Directorship left vacant by the late Harold Kemp.

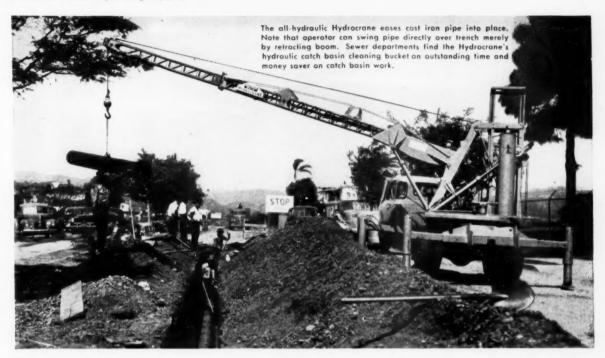


Rick Johnson, AWWA's Master of Registration was disappointed that attendance didn't go over the 2000 mark (by a goodly margin).—I tried to take his mind off that by getting him to "make book" on when the total membership of AWWA will pass the 10,000 mark. My own guess is about July, 1954, with a good possibility that it will drop below that figure about January, 1955, and then pass the five figure mark for good.

Among the humorists of the meeting was Tom Niles, partner, Greeley & Hansen, Engrs., Chicago, who spoke on vertical pumps and opened his talk with "I want you to know at what great sacrifice I am speaking to you on this subject—I sold all my vertical pump stock!"

Lew Finch, Vice Pres. & Chief Engr. of the Indianapolis Water Co. also chalked up some heavy laughter when he said he had thought that automatic signal systems could be worked like the bell call systems in

(Please turn to page 146)



HYDROCRANE'S built-in reach cuts down the "extra-cost" jobs

Bucyrus-Erie's 3/8-yd. Hydrocrane with hydraulically telescoping boom gives you 8 ft. more boom - right at your fingertips. This special extendretract action means substantial savings on ordinary jobs . . . outstanding savings on the tough extra-cost jobs outfits with ordinary booms can't handle. Look:

- 1. On sewer and water pipe laying, bydrant and valve setting, the Hydrocrane reaches under branches and low overpasses, between buildings, into alleyways - eases units into place quickly, easily.
- 2. On excavating work, the Hydrocrane digs trenches and manholes, uncovers pipe leaks, handles dozens of digging jobs - often by reaching out while the crane itself stays out of the way of traffic.
- 3. On yard work reaches into box cars . . . over fences . . . between stockpiles to move material, load trucks - in a hurry.

quick convertibility

By actual stop-watch test, crane has been converted to dragshovel front end by one man in less than one hour! And on trenching, telescoping action of Hydrohoe boom cuts lost time moving up by as much as 40 percent.

Get the full story on the all-hydraulic Hydrocrane with its many attachments.

SEND COUPON TODAY ...



with the Hydrohoe. Available with either 12- or 18inch dipper equipped with hydraulic ejector that kicks dirt out.

SOUTH MILWAUKEE, WISCONSIN

BUCYRUS-ERIE COMPANY South Milwaukee, Wisconsin Trench cut is started Gentlemen: Please send me Hydrocrane literature. Please send me Hydrohoe literature. State......



Allis-Chalmers meets the need for

Snow Removal Equipment that works the year round

When you select Allis-Chalmers Tractors and Motor Graders, you have units that do more than snow removal work. They are busy throughout the year on all types of excavating, grading, maintaining and material handling — one investment provides an economical all-round, year-round machine.

Allis-Chalmers diesel Motor Graders are versatile snow fighters



They mount V-type plow with wings . . .



or rotary type snowplow . . .



scarifier for breaking up ice or packed snow . . .



or regular grader blade for windrowing snow.

A Great Snow Fighter and All-Year Worker

Features that make the AD-40 the outstanding motor grader also make it outstanding as a snow fighter.

New Type, Built-In Hydraulic Power Steering is another Allis-Chalmers first in the motor grader field. Adds the ease and smoothness of hydraulic power to the wheel-feel accuracy of mechanical control. Makes snow plowing easier for the operator and assures greatest accuracy.

New Operator Convenience — unmatched visibility, with single-member tubular frame — true comfort, sitting or standing, with roomy operator platform, adjustable seat and steering wheel, easily reached controls — simple operation.

New Service Simplicity not found in any other grader. Universal drive shaft between clutch and transmission permits pulling engine without disturbing transmission. Transmission removable without disturbing engine or floor plates. Adjustments easy to get at, easy to make.

New Performance — with traction assured by tandem drive, big tires and 23,000-lb. weight (24,800 lb. with optional calcium chloride in tires) — plenty of power provided by 104 brake hp., 2-cycle diesel engine, which can be throttled down to half speed without loss of rim pull on grader — plus other proven Allis-Chalmers features such as exclusive Tubular Frame and ROLL-AWAY Moldboard.

Its performance, service and operator advantages make the AD-40 the finest heavy-duty grader on the market.

ROLL-AWAY is an Allis-Chalmers trademark.

HD-15 - 27,850 lb.,

For Economical All-round Snow Removal

. . . it's the low-cost Allis-Chalmers Model D Grader Windrows snow on streets with grader blade, then loads into trucks with rear-end loader. Scarifier breaks up stubborn ice and snow along gutters. V-type snow-plow is used to open outlying roads. The Model D offers the working advantages only a tandem drive grader can give — yet three Model D's can be bought for the price of one large grader.

MODEL D — 8,800 lb. (bare),
40 hp., four forward speeds to 25.6 mph.



For Clearing Walks, Parking Areas, etc. . . . it's the Allis-Chalmers Model IB wheel tractor with broom or snowplow — either "V" or trip blade type. Has mounting frame for quickly attaching or removing auxiliary equipment.

For Clearing Away Heavy Snows . . . it's any of the four modern Allis-Chalmers pace-setting crawler tractors with regular dozer blades. These world's finest tractors have the power and the traction to fight snows anywhere — opening mountain passes, pushing biggest drifts off highways, helping clear city streets in a hurry.

HD-5 - 11,250 lb.,

40 drawbar hp.

HD-9 — 18,800 lb.,
72 drawbar hp.

CRAWLER
TRACTORS

HD-20 — 41,000 lb.,
175 net engine hp.



For Big-Capacity Loading in City or Country
. . . it's Allis-Chalmers tractors with Tractor Shovels.
Snow is loaded into trucks or carried away fast by

big light-materials buckets — sand efficiently loaded to trucks from stockpiles. Ice and packed snow is broken up by bucket teeth or by rear-mounted rippers.

For Complete Information on any of these Versatile Snow Fighters See Your Allis-Chalmers Dealer

ALLIS-CHALMERS
TRACTOR DIVISION - MILWAUKEE 1, U. S. A.

WALK... DRY! SAFE! CLEAN!

IRVING "DRYWAY" GRATING

WALKWAYS and STAIR TREADS



IRVING GRATING

Provides the perfect Dry, Clean, Safe flooring for Sewerage disposal Plants. Gratings of Aluminum, Steel and other alloys offer a minimum of Maintenance Cost.

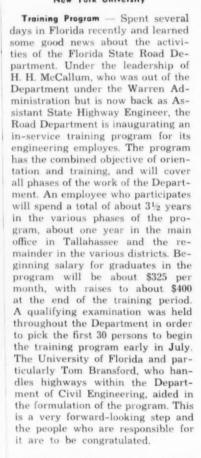
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IRVING SUBWAY GRATING CO., INC.

OFFICE and PLANTS at 5053 27th St., Long Island City 1, N. Y. 1853 10th St., Oakland 20, California

FOR ADEQUATE ROADS

BY LEO J. RITTER, JR. New York University



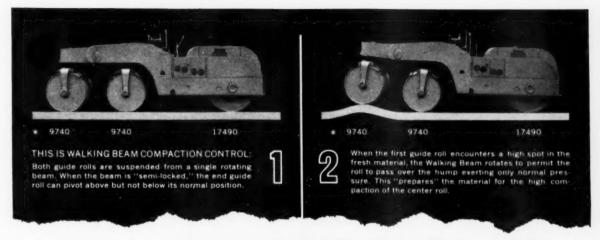
Highways of History — The oldest major road in the world crossed Asia to the Mediterranean Sea and covered a distance of over 1700 miles. This was the Royal Road of the Persians, which dates in recorded history back to 2000 years before the birth of Christ. By far the longest highway in history was the Old Silk Road, which traced a tortuous route from Peking and Shanghai in China and Cadiz in Spain, a distance of about 8000 miles. It was in use as early as 200 AD and provided a route for the movement of luxury



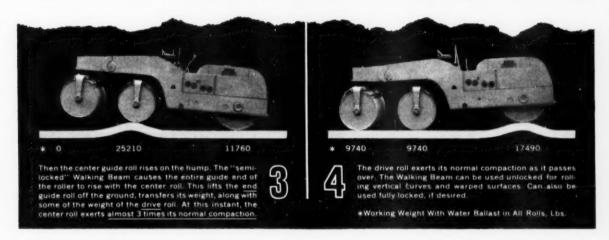
goods from the Far East to the Roman Empire. These and many other roads of the past and present are described in recent issues of the Highway Magazine, published by the Armco Drainage and Metal Products Association, Middletown, Ohio. Another wonderful bit of light reading on the fascinating subject of historical highways is a book "Public Roads of the Past", published by the American Association of State Highway Officials.

Bureau of Public Roads — Officials and staff members of the Bureau of Public Roads are busy writing reports these days, in order to supply the information needed by a top firm of management engineers in their review of the administrative practices and functioning of the Bureau. One field division, No. 5N with headquarters at St. Paul, has been eliminated; some of the states formerly in this division will be handled out of Kansas City and others from Chicago.

Trends -The Ohio Supreme Court has reversed the decision of a lower court which would have required the Ohio Turnpike Commission to take alternate bids on asphalt and concrete pavements. Construction on the Turnpike has been delayed by the legal hassle, and should now proceed without legal interference. A lot of engineers are breathing easier in other states because of the decision which, if the lower court had been upheld, would have established a far-reaching precedent for compelling state organizations to take alternate bids (an almost impossible task in many situations). interfering with the time-honored right of the engineer to select materials and methods of construction upon the basis of judgment and past experience. Another sort of event, which probably by no means indicates a trend, took place at a recent State Road Department meeting in Florida, when Charlotte County was announced as the low (Continued on page 144)



MOW A new 3-Axle Tandem with WALKING BEAM COMPACTION CONTROL



In 1936, Buffalo-Springfield introduced the world's first practical 3-axle tandem. Now Buffalo-Springfield engineering has further developed this revolutionary roller to give you Walking Beam Compaction Control.

With the new Walking Beam design used in the "semi-locked" position, extra compactive effort is actually applied to high spots only. This initial leveling action does away with the need for cross rolling,

eliminates extra job time and possible damage to material that has been compacted and set.

Using Buffalo-Springfield 3-axle tandems has meant as much as 60% higher tonnage compacted per day than with 2-axle tandems. Many states specify fewer rollers, less rolling time if 3-axle tandems are used. Save labor costs and capital investment. Roll better roads faster — the 3-axle, Walking Beam way!



WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF ROAD ROLLERS



Send for new KX bulletin today!



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SPRINGFIELD, OHIO



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Reg. U.S. Pat. Off.

THE PIONEER TRUCK SHOVEL



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SELF-CLEANING TRENCH HOE



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HAY FORK



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TELESCOPING BOOM

With Many More Money Making Attachments and Special Tools

LEADERSHIP

Year After Year for 34 Years

Proven Design—"QUICK-WAY" from the very start has been built simple and extra rugged—each part made of the finest steel to carry a big extra margin of strength. Constant improvement in design application and engineering has made "QUICK-WAY" better year after year—a machine that lasts longer, with less down time and more profits for the user.

4 Models—In "QUICK-WAY" you have your choice of four models.

Model L—1/2 cubic yard, 10 ton crane. Model E—4/10 cubic yard, 7-1/2 ton crane.

Model S—1/3 cubic yard, 5 ton crane. Model J—1/4 cubic yard, 3 ton crane.

For Standard Trucks and Special Carriers.

Two Hoists—One Boom—For erecting steel, installing heavy machinery, or any other work requiring the utmost accuracy, the "QUICK-WAY" Power Down, Worm Gear Drive, Boom Hoist gives the operator full power control of the load, either up or down to within a fraction of an inch. This installation does not affect the standard live Boom Hoist. This gives two different Boom Hoists at the operator's finger tips at all times.

All Steel Construction—Full use of the toughest alloy steels gives correct balance and weight distribution of essential working parts, puts strength where needed with minimum bulk. Because of their high capacity to weight ratio, rugged construction, fast mobility, big capacities and low maintenance costs, "QUICK-WAYS" have no equal. Ask your distributor today for a free demonstration.

"QUICK-WAY" Truck Shovel Co., Denver, Colo., U.S.A.

"QUICK-WAY" TRUCK SHOVEL CO. Mail Coupon Today!
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Please send NEW 28 page, two color FREE book giving complete details on all four "QUICK-WAY" Models.

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KEYED TO A COMMUNITY'S DEMANDS

Our engineers keep in constant touch with communities both large and small, both expanding communities and those that must replace worn-out equipment. Above you see E-4721 Curb stop for copper pipe service inlet and iron pipe at outlet; E-4717 Curb stop for copper service pipe (Minneapolis Pattern); and E-2931 Curb stop both inlet and outlet for iron pipe. The above items are available in ½ to 2 inch sizes. For complete information on our entire line write A. Y. McDonald Mfg. Co., Dubuque, Iowa

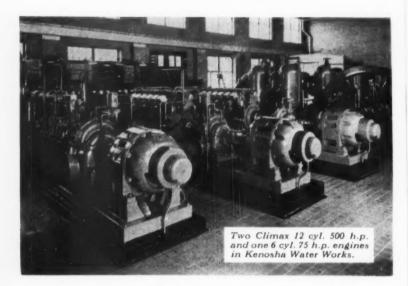
BRASS GOODS . PUMPS . OIL EQUIPMENT

Mg Donald



Climax BLUE STREAK ENGINES

PROVIDE DEPENDABLE PROTECTION



ON RECOMMENDATIONS of Alvord, Burdick & Howson, Engineers, the Water Works Department of the City of Kenosha, Wisc. elected to abandon rather than enlarge the existing steam plant and spent approximately \$200,000.00 in modernizing and enlarging its pumping station.

Improvements included the addition of two motor driven 9 MGD high lift and one motor driven 10 MGD low lift centrifugal pumps. To provide dependable standby protection each of the high lift pumps is also direct connected through a quick detachable coupling to a 500 H.P. Climax gasoline engine and the low lift pump is similarly connected to a Climax 75 H.P. gasoline engine.

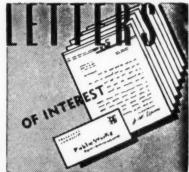
The present total capacity, including an existing 15 MGD motor driven pump, is 43 MGD, or 28 MGD SAFE capacity protected by standby engines. This is estimated to be ample for fire and domestic needs for an anticipated population of 170,000 by 1970.

In the Sewage Treatment Plant at Kenosha two Climax 75 H.P. sewage gas engines have been driving raw sewage pumps since 1940. Each of these engines has given over 59,000 hours of service.



ENGINE AND PUMP MFG, CO.

Factory and General Office: Clinton, Iowa Regional Offices: Chicago, Ill., Dallas, Texas



A LETTER FROM KOREA

It is surprising how few doctors (though they will not admit it) are able to show the administrative leadership required for a public health program where other doctors, vets, nurses and sanitary engineers are part of the team. Of course, an overseas job like this does not attract top-notch men because conditions are rough and families not permitted. The army sanitary engineer is, in the majority of cases, misused as to qualifications and when assigned to control of the medics rapidly becomes nothing more than an inspector. He should be assigned to detachments in the Engineer Service units that take the necessary action in insect control, in water supply, etc. He can be delegated to act as liaison officer with the Surgeons of the various

The Far East has been a challenge to our modern concepts. We could enlarge all of the water systems in Korea and put in sewer systems, but the people could not maintain the facilities due to economic factors.

A Sanitary Engineer in Korea

CLEANING ROADSIDES

In the April Public Works under "The Editor's Point of View" I note under "Better Maintenance Equipment Needed" that "Cleaning the roadside area of paper, bottles, cans, boxes, etc. is a regular job, especially after weekends and holidays. Gathering this material by hand is a slow and expensive procedure. Any equipment which will do this job will be much appreciated.

We have a terrible trash condition, particularly along the resort areas in this District, and we developed a highway vacuum cleaner which the Good Roads Machinery Corporation of Minerva. Ohio has

APSCO WIDENER-Modern, efficient, rugged machines that can speedily place most every aggregate in trench or shoulder building work. They even handle concrete (see lower photo above) or hot mix, without forms! Loose materials up to 10' widths-concrete or hot mix up to 6' widths.



BITUMINOUS PAVER FINISHER—The only paver finisher on rubber! Means lower upkeep—speedier backtracking. Lays from 8' to 12' 6" strips. Screed has crown adjustments—fuel oil healer with electrical controls.



TRENCH ROLLER-Here is a new kind of trench roller. Two compression rolls in tandem give effect of two separate rollers -vastly more economical. With rolls "dagleg" (as illustrated above) rolling width can be varied from 20" to 39"

FOR RESULTS YOU WANT AT COSTS YOU LIKE



ROAD BUILDING EQUIPMENT

Alert contractors and engineers everywhere are making it their business to get the facts on this labor-saving, money-saving equipment. Many bids have been awarded—and many tax-payers' dollars saved—as a result of using this soundly engineered, field tested machinery.

Higher labor costs and shortage of help make it increasingly important that you strengthen your bids and meet completion dates by using APSCO road widening equipment. Behind this familiar black and white oval lie many years experience in this field.

Many thousands of miles of highways have been widened in the past two decades. Many more thousands will be widened in the next few. APSCO road widening equipment has been and will be an important part in this improvement program.

Get full details from your nearest APSCO Distributor. or write the factory for full line folder PW-531.



ANTI-SKID CONTROL

Essential yet inexpensive . . . Farsighted street and highway authorities are ordering now! Send for specs and

ALL PURPOSE SPREADER CO., ELYRIA, OHIO





BASE PAVERS—Model P-120 (left), is smaller but very efficient paver. Has many features of larger model (P-125) on right, which has a capacity of 150 tons per hour. Both models produce accurate results without forms through various adjustments and controls. Handles any aggregate up to 4" (except concrete and hot mix). Good results guaranteed!

CUT maintenance paint COSTS UP TO 50%

with Dixon Flake Silica-Graphite Paints!

This FREE Bulletin shows how! Write for it today!

Just out! This new Dixon bulletin actually can save you up to half your maintenance paint costs. It explains, in non-technical language, how the unique overlapping pigment flakes of Dixon Silica-Graphite Paints form a heavier, stronger paint film that resists cracking and chipping and protects longer. Industrial users of Dixon Flake Silica-Graphite Paints report 9 to 10 years between paintings, against an average of 5 years or less for other paints. Get the whole money-saving story from this new Dixon bulletin. It's FREE! Mail the coupon today!



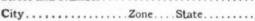
Paint Products Division

JOSEPH DIXON CRUCIBLE COMPANY

170 Wayne Street, Jersey City 3, N. J.

Yes!	I'd like to cut	maintenance	paint	costs	up	to
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improved and are manufacturing for sale, that does a fine job of picking up trash including gallon jugs. It is also a fine machine for picking up leaves in the fall.

We find that with a little ingenuity it can be used to clean areas, ditches and drop inlets and we consider it an excellent piece of maintenance equipment.

I'm sure the Good Roads Machinery Corporation would be glad to arrange a demonstration for one of your reporters if you are interested, or we could arrange a demonstration out here.

W. D. Sedgwick Asst. District Engineer Calif. Division of Highways Los Angeles 12, Calif.

MELTING

Over thirty years ago we designed a mechanical snow removal truck. Can some of our readers devise a method to melt the snow economically after it is in the truck so it can be disposed of to the sewer inlets?

> E. Stuart Ward, Asst. Engr., Design Div., City of Philadelphia, 6337 Magnolia Ave., Philadelphia 44, Pa.

1951 HIGHWAY

If you like figures, here they are. Seriously, however, this compilation of statistics by the Bureau of Public Roads shows the growth of our highway system and also gives some idea of the increased demands upon it. The list of contents indicates the scope of the information included.

Motor Fuel: Fuel consumed; Revenue.

Motor Vehicles: Registrations; Revenue and rates; Truck weights and capacities; Traffic characteristics.

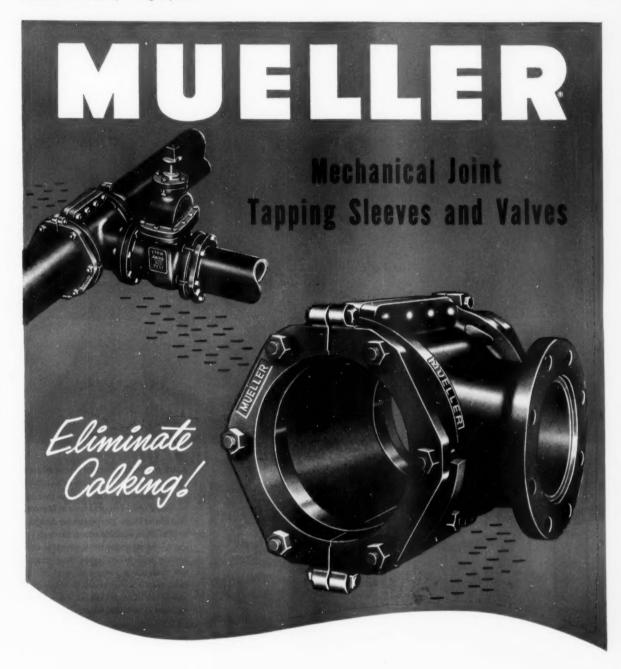
Highway Taxation: Disposition of receipts; Federal taxes.

Highway Finance: State highway finance; State highway obligations; State construction contracts; Local highway finance.

Mileage of Public Roads and Streets: State highway construction; State mileage; Local road mileage; Mileage summaries.

Federal Aid: System mileage;

It is obtainable from the Superintendent of Documents, Washington 25, D. C., at a cost of 60 cents.



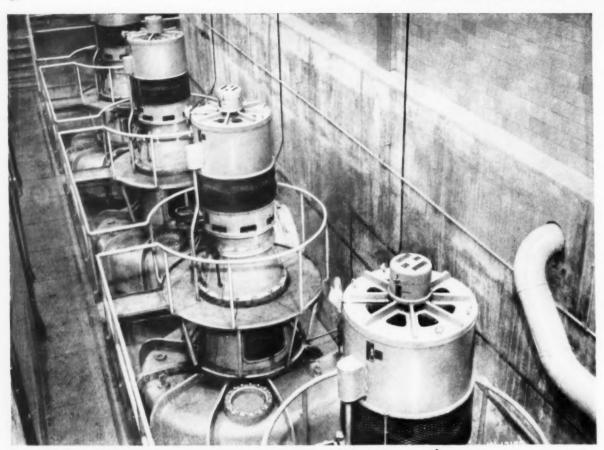
No pouring of lead or calking of any kind is necessary with Mueller Mechanical Joint Tapping Sleeves and Valves. A permanent leak-proof joint can be quickly and easily made even under adverse weather conditions.

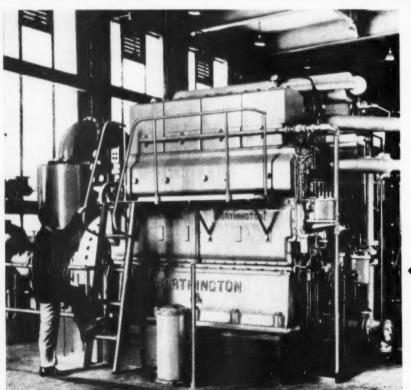
All end and side gaskets are totally confined to eliminate cold flow. With only two sets of gaskets, one sleeve for a nominal size of pipe will fit all classes of cast iron pipe regularly used.

Sleeves are available for immediate delivery to fit 4", 6", 8", 10" and 12" main with outlets equal size or smaller.



MAIN OFFICE & FACTORY DECATUR, ILLINOIS

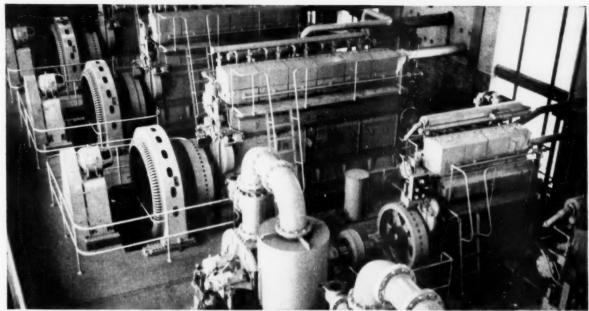




POUR OF THESE WORTHINGTON MIXFLO PUMPS, each with a capacity of 83 million gallons per day, move sewage through various stages of its treatment at Boston's Nut Island Plant. The pumps are designed to operate at variable speeds through the use of the magnetic drive which in connection with Worthington float control will maintain a pump-well level of not more than 3 inches above or below normal—even though pumping rates vary between 35 and 300 mgd.

these Worthington dual fuel engines are designed to operate on either gas or oil. They will maintain load in the event of a sudden emergency loss of gas supply by automatically switching to oil. Two of these 215-hp units drive the sewage aeration blowers at Boston's new sewage treatment plant at Nut Island

Now's the time to mail this month's Reader's Service card.



DUAL FUEL ENGINES AUTOMATICALLY MAINTAIN LOAD in the event of a sudden emergency loss of gas supply. These two 820-hp dual fuel engines and one 830-hp spark ignition gas engine drive three Electric Machinery generators. Two 215-hp dual fuel engines in the foreground drive positive displacement blowers.

Worthington equipment at Nut Island Plant helps Boston reclaim Quincy Bay beaches

Mixflo pumps have maximum capacity of more than 300 mgd of sewage

The new \$10,000,000 Nut Island Plant at Quincy, Mass., is now treating 95 mgd of raw sewage which was previously pumped directly into Quincy Bay.

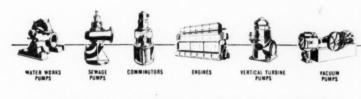
Four large Worthington Mixflo pumps, with Electric Machinery motor and magnetic drive, each with a capacity of 83 mgd, give this modern sewage treatment plant a reserve potential to meet any future demands.

Three large Worthington dual fuel engines drive the Electric Machinery generators which power the entire plant. Two smaller Worthington dual fuel engines drive the blowers for aeration of the sewage.

In addition to its larger pumps and engines shown here, Worthington also supplies comminutors, smaller sewage pumps, sludge removal pumps, and vertical turbine pumps for the water and sewage field.

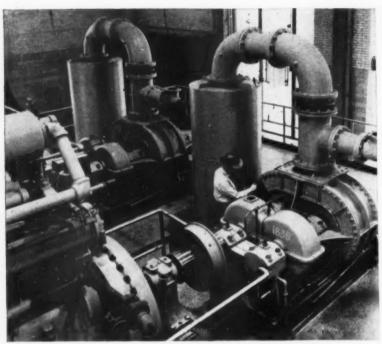
Write us for a list of Worthington installations in your area, and complete information on how Worthington equipment can solve your sewerage problem. Worthington Corporation, Public Works Division, Section W.3.1, Harrison, N. J.

W.3.1



All Major Public Works Equipment Under One Responsibility





Recent installation of two R-C Rotary Positive Blowers in Northeast Sewage Treatment Plant. Capacity of each unit is 5,000 cfm.

CONSULT THE "Specialists" ON BLOWER PROBLEMS

One of the many reasons why Roots-Connersville Blowers are such prime favorites among sewage treatment engineers is their unquestioned reliability. In small plants, with only intermittent or part-time attendants, this is of prime importance. For installations handling large volumes, even a temporary breakdown could have serious results.

Another factor contributing to the popularity of R-C equipment is the dual choice provided by the exclusive dual-ability line of both Rotary Positive and Centrifugal designs. Because we build both, R-C Specialists have no prejudices-they can recommend whichever type is best suited to the specific job to be done.

The long-time, satisfactory performance of R-C installations comes from

almost a century of specialized experience in handling air and gas. We have no other business-our time and facilities are 100% devoted to designing and building blowers, meters, gas pumps and related equipment. Much of this experience is in the sewage treatment field, in which we have more installations than any other company. So, when you have a problem of blowers, for new plants or for replacements, we suggest you call on the "Specialists" who are always at your service.



ROOTS-CONNERSVILLE BLOWER A DIVISION OF DRESSER INDUSTRIES, INC. 334 Poplar Ave. Connersville, Indiana



LEADERS IN THE PUBLIC WORKS FIELD

J. M. Boyd is engineer of the Board of County Commissioners for Palm Beach County, West Palm Beach, Fla., but will become Town Manager of Palm Beach this coming October. A graduate of Alabama Polytechnic Institute, that is, Auburn, with a BS in CE degree, he has been county engineer of Palm Beach County since 1926, except for military leave of absence from 1942 to 1946. His work with the county has included both design and construction of roads, bridges, drawbridges, airports and buildings. Much of the work, including all of the county road plans, has been executed with county personnel and equipment. From 1933 to 1942. he was a member of the Okeechobee Flood Control Board, and it was during this time that the levees around Okeechobee were constructed.

His military service was with the Seabees and he served in the Aleutian Islands, in the Central Pacific, in the Western Carolines and in the Philippines, attaining the rank of Captain in the USNR. He is a member of various engineering and professional societies, including the American Society of Civil Engineers, the Florida Engineering Society and the Florida Society of Professional Engineers.

Jake Boyd is an old friend of our Professor Ritter, and it is perhaps quite fitting that his picture appears on the cover of the issue in which the first installment of Engineering" appears.

What cities is

Fairchild

mapping now?

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These cities and many more are profiting from standard Fairchild photomaps and topographic maps at 1" = 200' with 5' contours.

The Mayor likes them! The City Council likes them! The City Engineer and Planning Commission, too! Why? Because Fairchild maps bring the answers to so many city problems right onto their desks!

(Illustrations reduced to 1" = 400')

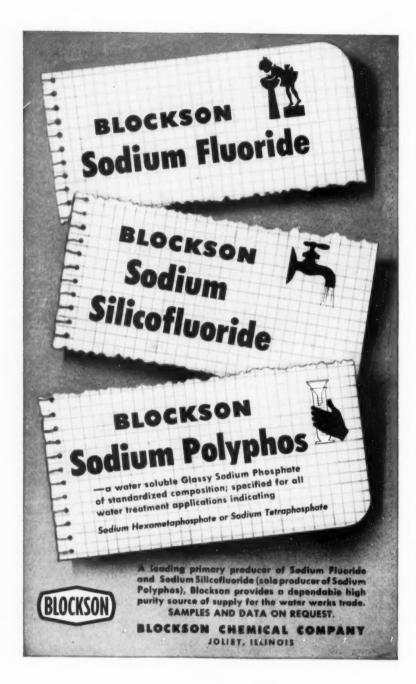
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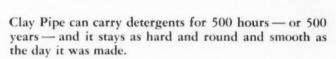




CLAY PIPE

can't get

Spongy



Comparative laboratory tests show that a 500-hour soaking in a hot solution of detergent makes other materials sometimes used for sewer pipe spongy and weak.

When you plan or install sewer lines, guard against "squash-outs." Insist on non-critical, readily available Vitrified Clay Pipe. It's the one pipe you can always count on — for prompt delivery, resistance to chemical action, and dependable performance. It's guaranteed for 50 years!

NATIONAL CLAY PIPE MANUFACTURERS, INC.

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EQUIPMENT DATA to Help Your

PUBLIC WORKS PROGRAM

Excellent Booklet Shows Aerial Mapping Technique

311. A clear explanation of the technique of aerial topographic map production is given in "Focusing on Facts". Striking photographs trace aerial photographs to final maps for highway planning, detailed city photomaps, reservoir surveys and many other applications. An excellent guide for public works and planning officials. Use coupon or write Fairchild Aerial Surveys, Inc., 224 E. 11th St., Los Angeles 15, Calif. Aerial Surveys, Angeles 15, Calif.

20-Page Book Shows All Snow Plow Features

313. The full line of Ross snow plows, including one-way "Rigid" types, trip mold-board plows, Vee plows, snow wings, sidewalk plows and plow hitches, hydraulic controls, plus spreaders for ice control are featured in a profusely illustrated booklet issued by the Burch Corp., Crestline, Ohio. Be sure to get this comprehensive booklet and review your plow requirements. Check the coupon.

How Motor Graders Beat the Snow Problem

307. The power and directional control of Austin-Western Four-Wheel Drive, Four-Wheel Steer Power Graders are a combination that beats the toughest plowing combination. Get data on plow and snow loader attachments for graders from Austin-Western Co., Aurora, Ill. Check the coupon.

Dual-Purpose Couplings For Construction and Repair Jobs

330. "Positive Seal" dual-purpose couplings for the permanent coupling or repair of gas, water and oil lines are described in Folder 101, issued by Morris Coupling and Clamp Co., Ellwood City, Pa. Complete price and specification data and the simple 6-step installation method are included. Check the

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg, Corp., Milwaukee 8, Wis. Get your copy by checking the coupon; you'll find this booklet both interesting and valuable.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

Easier Street Sweeping With Wilshire Municipal Sweepers

306. A handy chart included in a comprehensive 20-page bulletin enables you to check your street sweeping costs against the manhour savings of all Wilshire power sweeper models. Other helpful information shows all details on sweepers for large and small communities. Get this illustrated bulletin by writing Wilshire Power Sweeper Co., Glendale 4, Calif., or check the coupon.

What A Road Roller Should Give You

325. Many engineer ing design features that make Buffalo-Springfield rollers the answer to your needs are described your needs are described in an attractive bulletin covering the C-Model Two-Axle Tandems of Buffalo-Springfield Rol-ler Co., Springfield, Obio, Included are de-Onto, Included are details on open gridwork for better operator visibility, increased ground clearance and bevel gear drive. Investigate these and many other features listed in Form No. S 61-53. Check the coupon.



BUFFALO

SPRINGFIELD

Unusual Presentation Shows Tractors Inside and Out

323. The four Diesel-powered Allis-Chalmers crawler tractors are mesented "inside and out" in an unusual bulletin which shows details of construction of each model with full cutaway pictures, and the variety of applications of each on the job. You can get a copy from Allis-Chalmers Mig. Co., Tractor Div., Milwaukee I, Wis., or check the conton.

The Workings of Two-Way Radio Systems

328. Engineers who use two-way radio to direct snow removal operations say this type of communication is essential for efficiency in their work. To learn the basic systems in use, what they will do, and how RCA engineers will assist you in your plans, get Form 2J8055 from Mobile Communications section, RCA, Camden, N. J. Just check the coupon.

Easy-Reading Bulletins **Explain Surveying Instruments**

329. A series of instruments which explain the inner workings of surveying instruments have been issued by David White Co., 315 W. Court St., Milwaukee 12, Wis. Written in question and answer form, they make interesting reading for the beginner and experienced surveyor alike. Get your copies by checking the coupon.

"Quick-Set" Posts for Signs and Snow Fence

333. For quick, easy driving in any type of soil, be sure to check Buffalo Steel "Quick-Set" sign posts, available in any length you need and ready-punched for fast installation of signs and snow fence. Get full data from Buffalo Steel Div., H. K. Porter Co., Inc., Tonawanda, N. Y. Just check the handy cou-

Cut Digging Costs With a Tractor-Mounted Buckhoe

334. Your digging costs will be slashed when you mechanize operations with a Henry Backhoe. Easily attached to your tractor, by-draulically operated, available with several bucket widths. Be sure your department has the latest information. Check the coupon or write Henry Mfg. Co., Box 720, Topeka, Kans.

Snow Plows for Every Street and Highway Need

335. For details on the full line of Frink Sno-Plows, including the new taper-type reversible plow with hydraulic roll-over control, reversible trip-blade plows, Vee plows and all accessories, check the coupon today. Frink Sno-Plows, Inc., Clayton, N. Y.

Trucks for Long Municipal Service

336. The Oshkosh line of 4 and 6-wheel drive trucks, built to give long, dependable service in and off the highway work is described in several handsome bulletins. Get your copies now to check the model best suited to your needs. Us the handy coupon or write Oshkosh Motor Truck, Inc., Oshkosh, Wis.

Television Reception With Community Antenna

309. Municipalities in fringe or "hidden" areas can now enjoy clear television reception with the community antenna system described in a new publication of the Jerrold Electronics Corp., Philadelphia 46, Fa. The full story is in Catalog J-1001. Get a copy and find out how your city could benefit. Check the coupon today.

Helpful Data on Meters and Controls

322. Helpful information on meters and controls for water and sewage plants, power plants and other applications is offered in a

8-53

USE THIS COUPON to get detailed information

on products and materials mentioned in this issue. Circle numbers below and mail today.



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295 296 298 299 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336

New Products, pages 148 to 153:

8-1 8-2 8-3 8-4 8-5 8-6 8-7 8-8 8-9 8-10 8-11 8-12 8-13 8-14 8-15 8-16 8-17 8-18 8-19 8-20 8-21

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Cities Report Salt Use

319. The experiences of street and highway superintendents in the use of salt for snow and ice control are described in a series of reports which have been collected and reprinted in a 43-page book by the Cayuga Rock Salt Co, Myers, N. Y. Be sure to get your co y of "Lower Cost Highway Ice Protection" Just check the coupon. It's interesting and informative reading.

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314. Fast, accurate and economical spreading for the control and scal coating are features of the Spread-All manufactured by Century Engineering Co., Waukesha, Wis. Hydraulic drive gives precise control, saves labor and materials. Easily attached to all standard dump trucks. Check the coupon for full data.

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324. Over 800 items of apparatus for engineering tests of soils, concrete and offuminous materials are described and illustrated in a new 72-032e catalog published by Soiltest, Inc. 4520 W. North Ave. Chicago 39, Ill. All standard apparatus for field and laboratory engineering tests of soils are included. Get Catalog 53 by checking the coupon.

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317. The power crowder-arm of the Lessmann loader gives you power shovel advantages in this tractor-mounted unit, and enables you to fill the bucket in touch digging without spinning the wheels. Check the coupon for all the details on this rugged, heavy-duty unit. Lessmann Mfg. Co., Des Momes 4, Iowa.

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REFUSE COLLECTION AND DISPOSAL

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What You Should Know About Trickling Filter Underdrains

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Methods and Materials

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Helpful Design Data For Sewage Ejectors

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How Cities Clean Sewer Lines From Street in One Operation

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Get Data Now On This Catch Basin Cleaner

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

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36. "Packaged" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 population Write for full description and actual operating data for this type of plant. Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill.

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Discussion of Sewage Chlorination

316. Sewage chlorination and factors in selecting chlorine gas feeders are discussed in Keep Sheet No. 15 issued by Builders-Providence, Inc., 356 Harris Ave., Providence 1, R. I. All factors related to sewage chlorination are covered in this valuable reference leaflet. Check the coupon for your copy.







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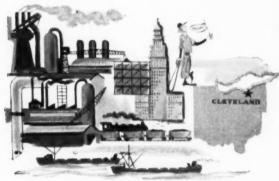
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Helpful Data on Bermico Pipe Fittings

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Efficient Blowers for **Activated Sludge Plants**

232. Many advantages of Roots-Conners-ville positive displacement rotary blowers are described in Bulletin 22-23-81-13, which also provides characteristic curves for operation with constant speed, multi-speed and variable speed motors and details of several types of blowers. Let this helpful bulletin by checking the coupon. Roots-Connersville Blower Corp., the coupon. Root tonnersville. Ind.

WATER WORKS

Check List for Proposed Water Supply Lines

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Methods of Chloringtor Control

98. Chlorinator control methods include manual, semi-automatic, program, rate, fully automatic proportional and split feed control. To assist the chlorinator user and his engineer or technical adviser in the selection of the control method best suited for each requirement a rubbication of Wallace & Teirnan, Inc., describes these methods in detail. You can get a copy of Publication TA-1013 C by checking the coupon.

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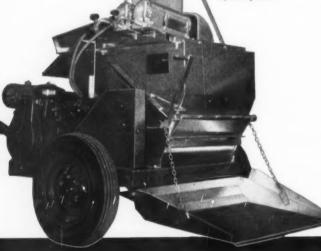
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Helpful Data on Corporation Stops

161. A complete line of brass goods for water works: corporation stops, curb stops, service pipe couplings, goosenecks and other fittings are illustrated and described in catalog W.39, issued by A. Y. McDonald Mfg. Co., Dubuque, Iowa. Get your copy for ready reference.

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Engineering Data On Mechanical Joint C.I. Pipe

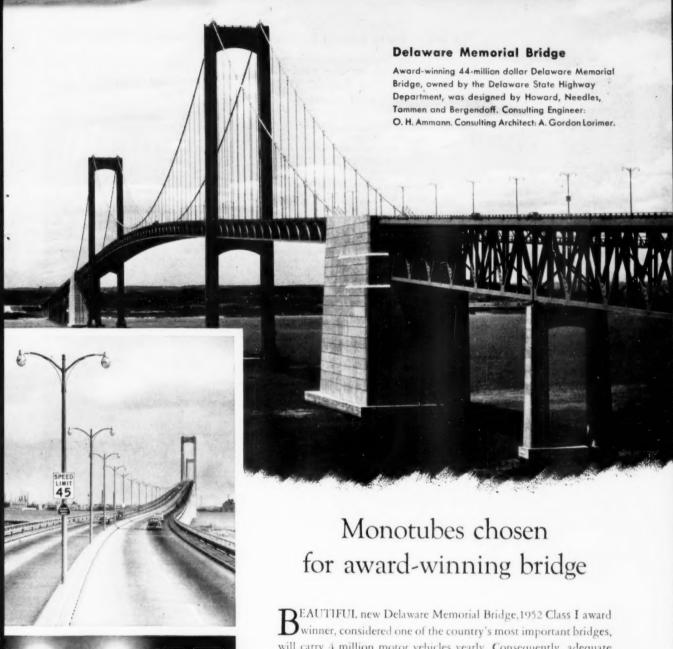
183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala Get this helpful data by checking coupon.

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Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves fittings and accessories for water works, filtration, sewage disponal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co, Annoton, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy, Get yours by checking the coupon

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Head Loss Data On Plastic Pipe

26. Carlon Products Corp., 10225 Meech Ave., Cleveland 5, Ohio, announces that authoritative data has been compiled on head load due to friction in Carlon plastic pipe and is available in the form of graphs and charts. The graphs show superior flow characteristics, attributed to the fact that plastic pipe is not "wetted" by water. Send for this data today by using the handy coupon.

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263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Tritor screens, flash mixers, seum breakers and other units are described. Check the coupon for your copy.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5002 issued by Darling Valve & Mig. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

Efficient Underdrains for Rapid Sand Filters

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Data on Cutting-In Valves, Repair Sleeves and Accessories

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Technical Data on Fluorides And Other Chemicals

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Helpful Data On Valve Boxes

291. Bulletin 35 issued by Buffalo Pipe & Foundry Co., Box 55, Sta. B., Buffalo, N. Y., gives full details on adjustable valve boxes, extension boxes and roadway boxes for water and gas. Get your copy by checking the coupon.

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Frink Reversible Type, One-Way Type, and V-Type Sno-Plows are interchangeable on the same truck attachment.

NOTICE: If you have had to wait months for replacements for your present equipment then you will appreciate the service that we can now offer you. The unique feature of the Frink V-Plows that prevents side thrust is embodied in the arrangement of the heel adjusting Chains shown in the cutaway photo at left. Frink Sno-Plows are so designed that the snow raises on the mouldboard (Fig. A.) above the adjacent snow before it is carried to the side.

The weight of this raised snow is transferred through the Heel Chains (Fig. B) to the truck attachment and downward to the front wheels – thereby increasing pressure against the road surface and preventing side slip.

These two factors cause the plow to push casier and entirely eliminates side thrust. Only in Frink Plows are these patented features combined for your benefit.

For details of this Sno-Plow write for catalog to nearest address below, Box PW-538

FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK DAVENPORT-BESLER CORP., DAVENPORT, IOWA FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.







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reene Aurora, Illinois, U.S.A.



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When making your will, the uppermost thought in your mind is to provide for the security of your loved ones.

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features hydraulic control of crowding speed, independent of bucket line speed, to provide maximum digging efficiency under all soil conditions One-man operation and mobility from job to job result in trenching at the lowest cost. Get Bulletin 705-A now for full details on this money-saving machine. Barber-Greene, Aurora, III.

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224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., 208 So. La Salle St., Chicago 3, Ill.

Heating, Thawing and Melting With Hauck Burner Equipment

277. A helpful 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles, For a useful addition to your reference file, get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 15, N. Y.

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280. Steel pipe lines, clevated tanks, treatment plant equipment and all other steel structures subject to rust, tuberculation and attack by aggressive soils can be protected by long-lasting Bitumastic enamels. Send for bulletins today so that you can specify the right coating for your job. Use coupon or write Koppers Co., Tar Products Div., Pittsburgh 19, Pa.

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299. Details on the several different types of elevated steel tanks, including capacity to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check coupon for your copy.

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproosing. You can have a copy by checking the coupon. American Bitumuls Co., 200 Bush St., San Francisco 4, Calif.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

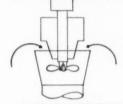
(More listings on page 48)

In Sludge Digestion... you need all 4!

Effective, two-stage, sewage sludge digestion involves far more than just a heated tank! There are four major — and interrelated — requirements.

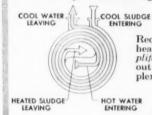
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Calls for intensive mixing in the Primary by means of high-capacity propeller and draft

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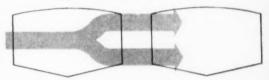
HOT WATER

3. Adequate Gas Storage



Demands a Secondary equipped with a movable, steel dome gas holder to even out fluctuations and insure a constant supply to gas utilization equipment.

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When buying a heavy-duty truck for snow removal, compare a 4-wheel drive Oshkosh with any truck — and you'll choose an Oshkosh! Designed and engineered for the hardest kind of grueling work. 35 years of construction experience is built into every Oshkosh Truck — and only Oshkosh has the all-important automatic self-locking differential in the transfer case. Yes! For snow removal, on-and-off highway hauling, road maintenance, municipal service and other year 'round jobs, Oshkosh is unequalled for operating efficiency —— low maintenance cost! Ask any user!



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One of the construction problems at Canton, Ohio's Sewage Treatment Plant was installation of a special welded tee on the effluent line between grid house and primary tanks.

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To order these helpful booklets check the coupon on page 32.

Helpful Installation Manual For Drainage Structures

52. A 46-page manual, well worth careful study by designers and held engineers dealing with drainage structures, culverts, sewers or conduits, is offered by Armo Drainage & Metal Products, Inc., Middletown, Ohio. Proper location of the structures, base preparation, assembly and backfill are some of the many items covered in detail. Use the handy coupon for free copy.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving netups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

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End Manhole Rattle The Easy Way

184. It's easy to safeguard manholes and end annoying rattles by using Tapax, a wear-resisting, resilient manhole cushion available in convenient 100-ft, reels from Joseph G. Pollard Co., Inc., New Hyde Park, N. Y. Full details in Bulletin 14. Check the coupon.

How to Get Better Concrete Construction

1862 N. Clay Street

198. A comprehensive report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while re-

ducing costs at the same time, is presented in 32-page Bulletin LH 9-52 of Master Builders Co., Cleveland 3, Ohio. Every engineer and contractor should study this helpful data. Check coupon for your copy.

How To Build Stabilized Heavy Traffic Pavements

233. A 16-page booklet published by Seaman Motors, Inc., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check coupon for copy.

Latest Data on Rubber Roads

296. A report covering all developments to date on the use of natural rubber in road surfacing of asphalt highways has been issued by the Natural Rubber Bureau, 1631 K St., N. W., Washington 6, D. C. Get your copy of this 52-page booklet which includes new data on research and full reports on test roads in many atates. Use the handy coupon.

Hot or Cold Patching Mixtures Prepared on the Job

304. By preparing your patching mixtures, hot or cold, right on the job, you can use them immediately with a minimum of handling. Get tull data on the McConnaughay Model HTD "Multi-Pug" Asphalt Mixer for fast, easy and comomical preparation of patch materials. Write K. E. McConnaughay, Lafayette, Ind. or use the coupon.

How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu, yd, dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 326 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Versatile Road Wideners Improve Highways at Low Cost

308. The full line of Apsco wideners, base pavers, bituminous paver finishers, widening chippers and tandem rollers is described and protusely illustrated in a helpful bulletin. Versatile wideners can handle stone, concrete or bituminous mix, all without forms. Be sure to investigate this easy way to modernize your highways. Get full data from All Purpose Spreader Co., Elyria, Ohio, by checking the coupon.

A Helpful Booklet For Those Who Build and Maintain Roads

310. "Governmental Graders," a booklet published especially for the 18.000 governmental agencies with jurisdiction over local-rural roads tells how the three sizes of "Cat" motor graders do the job on road building and maintenance programs. Of particular interest is a table of repair costs compiled from public records. Get your copy from the Caterpillar Tractor Co., Peoria 8, Ill., or by checking the coupon.

BUSINESS AND ADMINISTRATION

Insurance Benefits For Civil Employees

73. Civilian government employees are offered insurance protection at the lowest possible cost by Government Employees Insurance Companies, Gov't Employees Insurance Bidg., Washington S. D. C. Full details available by checking the coupon.

What Bonded Performance Can Do For You

121. On every construction job your city or county should be protected from a contractor's default or inability to perform the work.



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Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the Netco can be operated continuously, averaging 20 to 30 catch basins a day. The Netco with its two powerful pneumatic buckets (orange peel or clamshell) is simple to operate, has a hoisting capacity up to 1500 lbs., and easily removes all debris through openings as small as 16 inches.



NETCO DIVISION

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CORROSION!

Salt is fine for clearing streets and roads of snow and ice. It gets the job done quickly and easily, but . . . salt does encourage rust. Here is where BANOX* can help. As little as 1% BANOX added to the de-icing salt stops corrosive attack on automobiles, municipal equipment, bridges and other metal surfaces likely to be injured by salt-slush corrosion.

BANOX is easily added to salt by road maintenance crews. It does not have to be carefully or specially mixed, since the melting action and spreading by traffic takes care of even distribution.

Use BANOX and salt instead of cinders or sand and save money. Not only do you get faster, more effective snow and ice control, but since the mix does *not* clog gutters, sewers and catch basins, there is no costly clean-up in the spring.

End winter-weather corrosion worries . . . do a better job of snow removal without the nuisance of rust complaints.

Send for your free copy of "Stop, Look and Save with Banox" for full information on how the effective and economical Banox-salt team can serve you. Write to



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Engineered for Dependable Service on Air, Gases, Liquids, Semi-Solids

FULL FLOW

with minimum pressure drop.

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ANY CONDITIONS
or with quick shut-off manual RESISTANT
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or bubble-tight closure,
with quick, positive control and
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RESISTANI Made ruggedly for all conditions of corrosion, erosion, temperatures to 2000° F., pressures to 300 p.s.i.

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Butterfly, wafer or slide valves, 1" to 120" pipe size.

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Greenlee Bolt Hole Treaters

assure maximum life for poles, piles, timbers

Prevent decay around holes bored in new or old poles and timbers by pressure-treating each hole bored in the field. It's a simple operation with a Greenlem Bolt Hole Treater. Treats the entire hole... forces preservative into all the word cells around the bolt hole. Simply pour preservative in Treater cup until hole and cup are fuil. Pull back on handle, spring return does the work. Two models. Write for details. Greenlee

Bros. & Co., 2048 Columbia

Avenue, Rocktord, Illinois.

Learn what "Bonded Performance" can do for you. Write National Surety Corp., 4 Albany St., New York, N. Y., or check the coupon for full details.

Aerial Surveys and Maps from Photographs

229. Written in non-technical language, a 16-page booklet with this title gives a complete explanation of aerial surveys for the municipal field. Interesting step-by-step pictures show how planimetric and topographic maps, mosaics and atlas sheets are produced by Abrams Aerial Survey Corp., Lansing 1, Mich Check the coupon for your copy.

The Manufacturers' literature described on these pages is costly, so order just what you need. Use the handy mailing card or coupon today.

CONSTRUCTION EQUIPMENT AND MATERIALS

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 10 feet behind tractor in 140" arc and to depth of 8 feet. For full details check the coupon. Sherman Products, Inc., Royal Oak, Mich.

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated felder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy coupon for full data. Ernest Helmes Co., Chattanooga, Tenn.

Handbook of Contractors Pumps Is Easy to Use

49. Big 50-page Catalog P-10 covers dewatering pumps, pressure pumps, well point systems and electric pumps, and also features a special section of useful data which helps in the selection of the right pump for your job. Every construction engineer and contractor should have a copy of this valuable handbook. Just check the coupon. The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

All-Purpose TraveLoader For Windrows and Stockpiles

59. The versatile TraveLoader, product of J. D. Adams Mfg. Co., Indianapolis, Ind., is fully described and illustrated in a new 8-page catalog. Action pictures show how you can do quick and efficient materials handling on ditch cleaning, road reclamation, snow leading and other windrow and stockpile loading jobs. Check the handy coupon.

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60. Get information now on long-wearing blades for graders, scrapers, buildozers, snow plows and scoops; snow plow noses and run-ners; scarifer teeth and numerous other products for road machinery. Cheek coupon or write to Paper-Calmenson & Co., St Paul 8, Minn.

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the coupon today.

GRADING — The traction and digging power of the Model HM "PAYLOADER" easily cuts grade on this street paving job in spite of the many tree roots encountered.

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PITS & STOCKPILES — Whether stripping overburden, digging, loading or stockpiling, you can depend on the power and traction of 4-wheel drive "PAYLOADERS" to do a fast, efficient job.

MASTER OF MANY JOBS

Four-wheel drive "PAYLOADER" tractor-shovels are capable and versatile — able to do many street, road, pit, stockpile and yard operations. They drive quickly to the job at speeds up to 17 m.p.h. Big tires, plus 4-wheel-drive, gives them catlike traction and flotation on sand, snow and mud. Powerboosted steering makes them maneuverable and easy to handle . . . four gear ratios in each direction provide the right speeds to fit each task.

4-wheel-drive "PAYLOADER'S" are available in 1½ and 1 cu. yd. sizes. Five other "PAYLOADERS" from 1¼ cu. yd. down to 12 cu. ft. capacity, including rear wheel and front wheel drive types, are

available to meet every tractor-shovel need. Your Hough Distributor, one of 200 in the U.S. and Canada, is set up to serve you *right* — with extensive application experience and complete parts and service facilities. The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill.

WRITE for full information on any of the "PAYLOADER" models: FourWheel Drive HM — 1½ yd. and HR — 1 yd.; Rear Wheel Drive Models HY — 1½ yd., HF — ¾ yd., HE — ½ yd.; Front wheel drive Models HAH — 15 cu. ft., HA — 12 cu. ft.





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Want to locate a truck?





Find it FAST . . . with RCA 2-Way Radio

—says Irvin R. Worthington Burlington County (N. J.), Road Supervisor

"Our 11 trucks are on the go most of the time," says Mr. Worthington. "But with radio I can contact any of them on a moment's notice.

"We cover 500 highway miles in good weather or bad, and each truck is on call every minute of the day. In any emergency—in case of breakdowns—drivers report in by radio, and we change dispatching instructions without a minute's delay."

"To figure savings," says Mr. Worthington, "I just total the number of times we've rerouted an extra batch of concrete, eliminated cruising between jobs, gotten emergency crews out in a hurry—and I estimate we've increased our efficiency 50%."

Do It BEST with RCA 2-Way Radio. EASY TO USE as your telephone • COMPACT—takes no more space than a spare tire • TOUGH—constructed to take rough field conditions • RELIABLE—engineered by the leaders in electronics • PRACTICAL—installation and maintenance available from RCA Service Company.

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Examining a Tractor Piece by Piece

99. The 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-9 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need, Get your copy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

Helpful Booklet on Carryable Centritugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is affered by the Homelite Corp. Both gasoline and electric models are discussed, and requirements outlined for many applications, lust check the coupon for your copy. The Homelite Corp., 2125 Riverdale Ave., Port Chester, N. Y.

Have You Investigated Aluminum Gratings?

200. Aluminum gratings for walkways, bridge decking, and stair treads save weight, resist corrosion and are easily handled. Get complete design data, including safe load tables, standard panel widths and weights, from Irving Subway Grating Co., 50-53 27th St., Leng Island City 1, N. Y. Just check the handy coupon.

Trenching Made Easy With Hydraulic Dragshovel

216. The Bucyrus-Erie "Hydro-Hoe", a completely bydraulic dragshovel has two separate digging actions to dig a level, scallop-free trench and greatly reduce hand trimming. Because to investigate this rugged, easily operated machine. For details write Bucyrus-Erie, Hydrocraue Div., So. Milwaukee, Wis., or check the handly coupon.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

Profitable Construction with Payloader

234. A comprehensive, 12-page catalog filled with on-the-job photos showing a wide variety of earth-moving, material-handling, hitting and carrying jobs being performed by the multi-purpose tractor-shovels known as "Payloaders" is now available. Helpful job data, specifications and features of the complete Payloader line are included, with illustrations of useful accessories. Copies of this colorful catalog No. 217 can be obtained from The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill., or by checking the coupon.

Give Full Protection To Treated Poles and Timbers

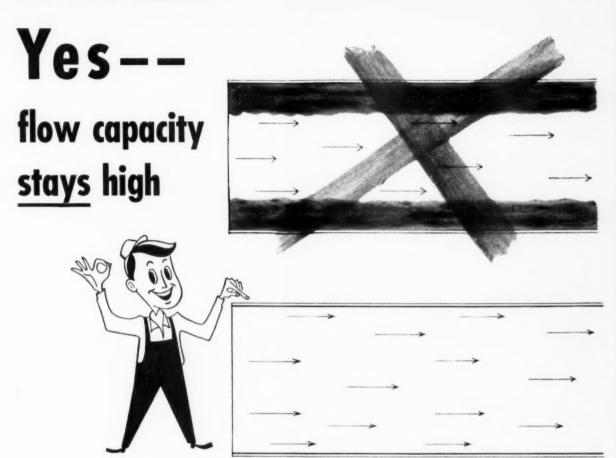
267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Greenlee Bros. & Co., Rockford, Hf.

Be Sure To Investigate Truck Shovels

286. A complete and factual booklet issued by "Quick-Way" Truck Shovel Co., Denver, Colo., gives all the details on four truck shovel models. Profuse illustrations and descriptive copy show the reader how these adaptable machines do the work quicker and easier. Check the coupon for your free copy.

Drill Concrete With Your Ordinary Electric Drill

295. Substantial cost-per-hole savings are claimed for Tiblen Rotary Drills which penerate 2° to 4" per minute. Available in sizes 1/4" to 4". Cutters can be resharpened. Full data from Tiblen Tool Co., 209 Los Molinos, San Clemente, Calif. Just check the coupon.



...when you protect pipe lines with BITUMASTIC® 70-B ENAMEL

PIPE LINES don't "shrink" when they are lined with Bitumastic 70-B Enamel ... because this durable enamel prevents rust, corrosion, incrustation and tuberculation. When your pipe line's coefficient of flow stays high, there's no need to spend money on over-sized pipe in order to allow for future loss in flow capacity.

Further, there's no need to specify a wall thickness any greater than that required to give the pipe adequate structural strength. Because Bitumastic 70-B Enamel—when applied to a thickness of $\frac{3}{32}$ "—protects the exterior of pipe against the

corrosive action of the soil in which it is buried. This makes it unnecessary to specify pipe with greater wall thickness in order to compensate for corrosion.

Summed up, Bitumastic 70-B Enamel saves money in two ways. For your large-diameter water lines, you

can specify pipe with smaller inside diameter and with less wall thickness. Use strong, durable steel pipe, lined and coated with Bitumastic 70-B Enamel, and give your community these worth-while savings. Write for full information about hot-applied coatings.



KOPPERS COMPANY, INC., Tar Products Division, Dept. 855-T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

To order these helpful booklets check the coupon on page 32.

Booklet Helps Design of Custom-Engineered Steel Buildings

110. Custom-engineered Buildings
110. Custom-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 32-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the coupon or write to Butler Mfg. Co., Kansas City, Mo.

Trencher Fits Municipal Needs

315. A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17. Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, manueverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the coupon.

Details on Motor Grader Construction and Use

312. In a handsome catalog, profusely illustrated with diagrams and photographs of unusually fine quality, the Galion Iron Works and Mig. Co., Galion, Ohio, has presented all details on the construction and operating features of their Model 118 motor grader. This impressive 28-page catalog, No. 375, is available without charge. Just check the coupen.

STREET LIGHTING

Investigate "Monetubes" For Modern Street Lighting

76. Monotube street lighting poles are offered in modern design for use with either incandescent or fluorescent luminaires on all street and highway lighting applications. For helpful information on these attractive and economical poles write to Union Metal Mfg. Co., Canton 5, Ohio, or check the coupon.

Mercury Vapor Lights Need Efficient Transformers

225. To get all the benefits of mercury vapor lamp illumination, efficient transformers are required. Complete data on Jefferson Transformers for all outdoor and indoor installations is offered in 16-page illustrated Bulletin 521-5 by Jefferson Electric Co., Bellwood, Ill. Particular attention is given to street lighting applications. Get a copy now by checking the coupon.

CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Enterprises, Inc., 8733 So. State St., Chicago, Ill., by using coupon.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

145. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt wasse, saves time and labor. Get Folder BL for full details on this apreader and table of material application rates. Use coupon or write Tarrant Mig. Co., Dept. PW, Saratoga Springs, N. Y.

Get Full Data On Aggregate Spreaders

231. Accurate control for spreading crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on both trailer and tailboard types available by checking the coupon. Highway Equipment Co.. 630 D. Ave., Cedar Rapids, Iowa.

WEED CONTROL

Better Mowing and Brush Removal

30. Fast, versatile Wood rotary mowers are available in seven models to suit all types of municipal maintenance. Upkeep costs for roadside mowing, brush cutting, leaf mulching, park maintenance can all be reduced with efficient equipment. Get full details by checking the coupon. Wood Bros. Mfg. Co., Box 148B, Oregon, III.

Chemical Weed Killers Are Fast and Effective

117. Be sure to check Polybor-Chlorate and concentrated Borascu for fast, economical non-selective destruction of weeds and grasses. Features and applications of these effective products are outlined in bulletins available from Pacific Coast Borax Ce., 630 Shatto Pl., Los Angeles 5, Calif. Check coupon for full data.

TRAFFIC SIGNS

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "EZ-On" traffic signs faces ready for immediate shipments. Reflectorized faces cost only a fraction as much as new signs and are easily attached to existing traffic signs. Use the coupon for data today. Grace Sign & Mfg. Co.. St. Louis 18, Mo.



BUFFALO STEEL QUICK-SET SIGN POSTS put signs up FASTER to stay up LONGER



Easy driving ... purshed with holes 1" or 2" apart for quick bolting of road signs and route markers ... specially coated with long life baked on paint, has made Buffalo Steel Quick Set Sign Posts the accepted standard with municipal, county and state engineers.

Buffalo Steel Quick Set Sign Posts are available in any desired length to meet your exact requirements. These flanged channel sections are made of heavy-duty high carbon rail steel.

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BERMICO SEWER PIPE

The Root-Proof Fibre Pipe for Outdoor, Underground Non-Pressure Use That's—

Lighter! Bermico weighs far less than other types of pipe. So light you can easily lift and carry several 8-foot lengths at one time.

Tighter! Bermico has strong, tapered sleeve joints that are root-proof, water-tight, will not pull apart or get out of alignment. A few hammer taps seal joints permanently. No joining compound is needed.

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A complete new line of Bermico Fittings — Tees, Wyes, Bends — is now available for use with Bermico Sewer Pipe.

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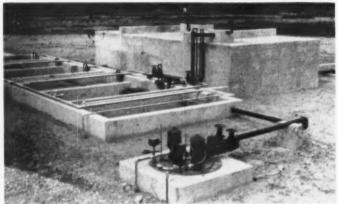
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BLACKBURN-SMITH PNEUMATIC SEWAGE EJECTORS TO LIFT SEWAGE AND SLUDGE AT TREATMENT PLANTS

ONLY the Blackburn-Smith Ejector System offers the following choice of controls:

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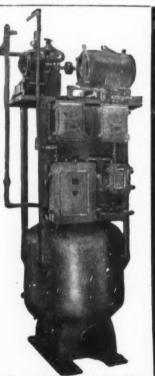
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BOOKS IN BRIEF

RADIOISOTOPES IN SOIL MECHANICS

This symposium was presented at the March 1952 meeting of Committee D-18 of ASTM. The three papers which are now printed describe apparatus which applies certain phases of atomic science to the determination of soil moisture and density. Available from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., at \$1.25 each.

DIRECT SHEAR TESTING OF SOILS

This symposium was presented at the June 1952 meeting of ASTM. The six papers and the panel discussion, now printed, were designed to show examples of the successful use of direct shear methods, and to outline the advantages, disadvantages, and limitation of direct shear testing. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., at \$2.00 each.

ORIGIN-DESTINATION

In this 158-page bulletin, a comparison is made of the results obtained by a home-interview origindestination survey with those from a post-card survey. Eight items were considered and analyzed. The price is \$2 from the Director, Engineering Experiment Station, Purdue University, Lafayette, Ind.

INDUSTRIAL WASTES

There are seventeen chapters in this series of monographs which were written by experts in the various fields and edited by Willem Rudolfs. Covered are wastes from milk, canning, packing, fermentation, tanning, textile, paper, acid and explosives, petroleum and atomic energy industries. There are 486 pages and many illustrations. Price \$9.50. Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y.

WATER SUPPLY & SEWERAGE

This is one of the few modern books that covers the two related fields of water supply and sewerage. This is the third edition and it has been brought well up to date. There are 298 pages on water supply and purification, and 247 pages on sewerage and sewage treatment. There are 241 illustrations. By Ernest W. Steel. McGraw-Hill Book Co., New York, \$8.

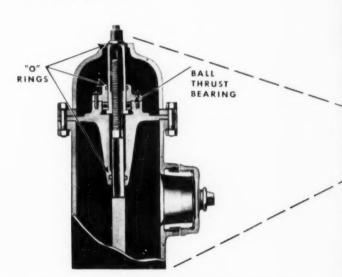
In Cuyahoga Falls...

Darling hydrants for 45 years ...now DARLING B-50-B's are going in!

EASIER maintenance and rugged construction... basic design advantages of Darling hydrants and valves... have been paying off in Cuyahoga Falls, Ohio, since way back in 1908. In the words of City Engineer T. H. Sauter, "The City of Cuyahoga Falls has been a user of Darling hydrants and valves since 1908. The ease with which repairs can be effected has been a factor in the determination of the city to standardize on this type of equipment."

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Cuyahoga Falls, and hundreds of other cities too, are now installing the new Darling B-50-B hydrants. This dry-top, ball-bearing hydrant opens quicker, operates easier, and eliminates bothersome packing lubrication. Moreover, the special Darling B-50-B "O" rings are insurance against loss of lubricant for threads and bearings ... and never let a drop of water reach the operating threads.



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To find out, without obligation, how an Elliotte vacuum leaf loader can



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DRAFTING PRACTICE

"Simplified Drafting Practice" teaches new methods for producing drawings faster and with less effort; and drawings that are easily read and interpreted. "Before and after" production drawings are shown to illustrate that simplification of delineation, elimination of non-essentials and extensive use of freehand can speed up work 20 to 30 percent. 153 pages; numerous illustrations. By William L. Healy and Arthur Rau. John Wiley & Sons, Inc., New York, \$5.

DRAFTING BY THE MODEL METHOD

This book by Musacchia, Fluchere and Grainger is a complete course in drafting which employes an entirely new method of instruction, the model method. Cut-out 3-dimensional models accompany the fully illustrated text in which the training of a competent draftsman is outlined step by step. The authors say, "The purpose of this book is to get you a job as a draftsman." Published by Arco Publishing Company, 480 Lexington Avenue, New York 17, N. Y. Price \$3.50 paper; \$5.00 cloth.

PIPEFITTERS

Though a little outside of the engineering field, this book contains a great deal of valuable information that engineers can use in their work. Among the data of value are such things as laying lengths where joints are concerned; mitering bends; offsets; and many other things that face an engineer in design work involving pipe. By Forrest R. Lindsey; The Industrial Press, 148 Lafayette St., N. Y. \$6.

A CREATIVE PROFESSION

The Engineers' Council for Professional Development has issued "Engineering—A Creative Profession." The price is 25 cents per copy; less in numbers. Write ECPD, 29-33 West 39th St., New York 18, N. Y.

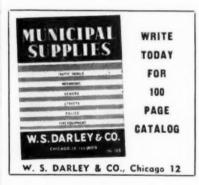
WATER POLLUTION RESEARCH

The 1952 report of the Water Pollution Research Laboratory of the Department of Scientific and Industrial Research, England, is now available. This is a 64-page booklet covering water, sewage, industrial waste treatment and polluting effects of sewages and wastes. Get it from the British Information Services, 30 Rockefeller Plaza, New York 20, New York, for 65 cents.



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NEW U-1091 natural gas power unit develops 187 net h.p. at 1400 rated r.p.m.; 200 net h.p. at 1600 max. r.p.m.; maximum torque, 820 lbs. ft. (a) 800 r.p.m.



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NEW U-372—83 net horsepower at 1800 rated r.p.m.; 91.5 (# 2200 r.p.m.; maximum torque, 263 lbs. ft. (# 1200 r.p.m.



NEW U-220—50.5 net horsepower at 1800 rated r.p.m; 62 @ 2400 r.p.m.; maximum torque, 151 lbs. ft. @ 1200 r.p.m.

IH Announces Seven New International Engines

Seven new six-cylinder, carbureted, valve-in-head engines have been added to the International line, which now includes 18 models—diesel, gasoline or gas—ranging from 16.5 to 200 net horsepower.

These new models are the result of more than 45 years of IH engineering and manufacturing experience building a complete line of heavy duty engines for tractors, trucks, construction and oil field equipment and individual power unit applications.

These new units have the durability, flexibility and economy to meet your requirements for lower cost per-

formance. The unmatched network of IH district offices, parts depots, distributors and dealers puts complete service facilities practically at your door.

If you are an individual user of engines, it will pay you to see your nearest International Industrial Distributor or Power Unit Dealer for more complete information. If you are a manufacturer, your nearest IH district office will be glad to help you engineer these engines into the equipment you are building.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

POWER THAT PAYS



INTERNATIONAL

ROAD BUILT THIS WAY WILL BE

Every Mile a Level Mile of Uniform Thickness

-True-not just at the shoulders where the line is guidance but true the full width and length of the completed road.

Start with an accurately graded subgrade. Then, using the Adnun equipped with the Adnun Fluid Level lay the base with any material you desire—crushed stone, gravel, stabilized mix. The Fluid Level assures a level surface the full width and length of the road. It takes out the dips that won't show under the straight edge and it will correct for any slope at any station. The maintenance of accurate thickness assures an approach to uniform density that floating mechanisms and compacting devices cannot equal! The oscillating action of the cutter bar permits material to find its natural position for better "keying".

With a true base it is equally possible to lay a true surface. Each course can be fully controlled as to thickness with the natural result in the improvement of density. There will be no thick or thin spots. There will be no hollows to collect water. The center will be as true to specification as the shoulder.



Every Mile a Level Mile of Uniform Density

Never before has it been possible to secure such full control of laying materials from base to surface. It means longer life, safer, lower cost road for the taxpayer. It can mean a great savings in material and better estimates for the contractor. Investigate this certain method of building accuracy into modern roads. If you do not have it ask for the booklet, "Put A Level On Your Roads".

The Booklet, "Put A Level
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some new thinking on thickness
and density control. If you
have not seen it, ask for it.



BLACK TOP PAYER

BLACK TOP PAYER

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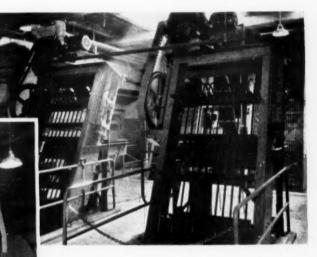
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for dependable performance... low maintenance...

Jeffrey BACK-CLEANED Screens

The treatment of water, sewage and industrial waste by mechanical means has definitely proved to be most effective and economical. It is now the accepted standard for new plants, including those for small villages.



Based on new design principles, these Jeffrey mechanically-cleaned bar screens are practically foolproof.

Jeffrey bar screens are furnished coarse or fine (as shown) with round or rectangular bars, in widths and lengths to meet job requirements. Write for Catalog 833 on Jeffrey equipment for industrial waste, water and sewage treatment.

Other Jeffrey sanitation equipment includes:

Screening Grinders
Grit Collectors and Washers
Sludge Collectors for Primary
and Final Settling Tanks
FLOCTROLS (Controlled
Flocculation)
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Chains and Sprockets

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Dry Feed Chemical Machines
Biofiltration Plant Equipment
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EXTRA STRENGTH FOR PIPE JOINTS with the Bondactor

Gun-grout those pipe joints with the BOND-ACTOR. It's the fast, sure, modern way to stronger, longer-lasting joints. BONDACTOR works equally well on both outside and inside pipe joints . . . gives a stronger seal against water and roots, and seals up to five times faster than outdated manual methods.

A BONDACTOR will mechanize many repair and construction jobs you now do manually. It will save you dollars, it will save you time, and it will save you labor. Write for complete information.

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3 MODELS AVAILABLE

Model 750. Capacity: $V_2-3/4$ cu. yd. per hr. Operates with 75 or 105 CFM compressor.

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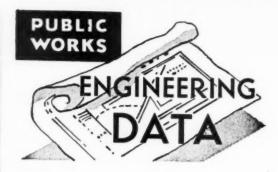
Capacities vary with material being gunned and with specific operating conditions.

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Sup't., Distribution and Production Indiana Gas & Water Co.

N our opinion, we have three pieces of equipment which have proven their value in our work. These are: (1) Quarter-ton Jeeps equipped with Auburn trenching attachments; (2) Ferguson Model 30 tractors with front hydraulic lifts and rear grader blades; and (3) Earthworm boring machines.

The Jeep trenchers are very efficient for small main and service installations in confined areas and/or on landscaped areas where heavy machines would do permanent damage. While not as fast nor as durable as the regular trenching machines, they are very valuable for this special type of work.

The Ferguson tractor is very maneuverable and is capable of backfill work and of handling pipe up to 8 ins. in size on any construction job. It is capable of backfilling on landscaped property with a minimum of damage; and it is invaluable for final ditch grading after backfill and for drainage work where natural drains have been disturbed or interrupted because of construction. With a special transmission, this machine can be self-propelled at a speed of 25 mph from job to job, thus eliminating the job of loading and unloading the equipment at each location.

The Earthworm boring machines have saved both time and money in the construction of services and small mains under paved streets. These machines are both fast and accurate and we have five of them constantly in use in the New Albany-Jeffersonville-Clarksville area.

Jeep-Mounted Trenching Machine

The Medford (Ore.) Water Commission, of which Robert L. Lee is Ass't. Superintendent, has a small trenching machine mounted on a Jeep. This machine saves many hours of hard labor on service lines. Its mobility cuts the time required to move from job to job; and its narrow cut—only 7 ins. wide—keeps pavement cutting and damage to a minimum. A bulldozer blade has been added and is used for backfilling.

Lime Slurry Proportioner

A lime slurry proportioning device is in use by the Mahoning Valley Sanitary District, Ohio, Merrill L. Riehl, Sup't. of Water Purification. This device enables one slaker to supply four mixers and sedimentation basins in parallel. The resultant reduced velocity gives greater efficiency and permits operation at a rate above normal capacity.



or Consequences?



The dangerous and implacable enemy, at the bottom of all World disorder will seize on a truce to direct his nefarious talents in other directions and to other trouble centers. The threat to the safety of America and the free World remains and will be with us until the ultimate showdown.

A Civilian Defense warning system is not just a thing of the present, it is a municipal necessity for the future, as important as your lighting or water system. Don't put off your preparations for an inevitable need. Any delay is on borrowed time; act now while Government funds are available to help you.

The FEDERAL THUNDERBOLT Siren is still the preponderant choice of American cities because of its super sound output, its extreme flexibility and its comparatively inexpensive adaptability in installation.

This great and radically different audible signal, electrically powered, has built a reputation that is unapproached. It is now also available powered by a gasoline engine to provide a simple but dependable installation in certain areas which are not entirely satisfactory for electric operation.

The new gas powered model is by far the most dependable internal combustion powered signal that has ever been put on the market. Literature describing its many advantages will be available shortly; write today requesting it.

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Digester Cleaning and Sludge Gas Use

At the Detroit, Mich., sewage treatment plant, a digester was emptied, inspected and cleaned. Heating coil scale was removed and piping changes made to permit better raw sludge feed. In refilling, the cover was floated with raw sewage, then seeding sludge was added. Gas production was noted in seven days after raw sludge was introduced. Foaming was evident for a few days, but subsided when feeding was stopped for eleven days. During this 11-day period, gas production increased, dropped off when feeding was resumed, and quickly picked up again. In two weeks it was back to normal.

The 350-hp gas engine was operated for a total of 4,890 hours, but no gas was available during the period that the digester was being cleaned and brought back to normal operation.

Air Compressor on Rubber Saves Money

In making cuts in pavements to install, replace or repair services, and repair leaks in mains, Terre Haute, Ind., finds that much time is saved by using an air compressor mounted on rubber tires for fast movement. This unit also furnishes power for operating a valve wrench for rapid closure or opening of large valves.

Over the past two years, water use has increased 5.6 percent, due to more customers, increased use of air conditioning equipment, and similar reasons. However, since the source of supply is the Wabash River, there is no problem of water shortage. A. E. Blood is Manager of the Terre Haute Water Works Corp.

Controlling the Rate of Filtration

The rate of filtration in Middletown, N. Y., Kenneth B. Abt, Deputy Commissioner of Public Works, varies widely and the finished water storage capacity is small. A Builders Chronoflo accurately and efficiently controls the chemical dosage, which is applied by Wallace & Tiernan dry feeders.

Editor's Page

(Continued from page 7)

the work of others. Unlike our latest movies, not one of these dimensions can be illusory in the well-rounded engineer.

Many professional men in the municipal engineering field have succeeded in all three dimensions, but some still seem to view one of these essentials through a poorly tinted lens. That is the administrative phase, which involves also initiative and imagination. But all three categories are within the reach of the man who is willing to work for them. Engineering periodicals and texts will supply technical fundamentals on new developments in the field; careful planning and effective use of today's labor saving machines go a long way toward getting the job done quickly and economically; and ready acceptance of new duties and a broader recognition of our responsibilities will add to the depth of engineering services.



*The first real pipe that is plastic!







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Buy the Pipe with the Stripe!

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WHAT BETTER PROOF of Rex superiority? over 700 cities and industries rely on

Rex® Conveyor Sludge Collectors for efficient, dependable and economical operation. These precision engineered sludge collectors are applicable

CITIES AND INDUSTRIES!

for all types of sludge handling or surface skimming conditions in either sewage, water or industrial waste treatment application . . . no application is too large or too small . . , and each receives the full benefit of Rex Engineering.

Here are some of the outstanding time-proven features of Rex Sludge Collectors that make them leaders in their field:

- * Balanced Equipment Design-design proportionate throughout.
- * Rex Z-Metal Chain and attachments-corrosion and wear resistant.
- Self-Aligning Bearings-easy to install. Compensate for tank irregularities . . . prevent accumulation of settled solids.
- * Offset Split Drive Sprocketseliminate bulky cantilevered brackets. Easy to replace.
- Centralized, Hardened Wearing Shoes-eliminate splitting strains on wooden scraper flights. Means longer life, lower maintenance.
- * Double Life Sprockets-chain engages only every other sprocket tooth.
- ★ Drive Unit—compact, totally en-closed. Shear pin protection. Jaw clutches provided where independent operation is required.
- * Sub-Assemblies shop assembly of drive units and shaft assemblies assure proper alignment and fit.

MAKE SURE YOU WILL BE THE NEXT ONE to profit from Rex design and Rex quality. Get all the facts on Rex Conveyor Sludge Collectors. Call your nearest Rex Sanitation Engineer or write for Bulletin 47-9. Chain Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wisconsin.



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A Message to Men I in charge of Ice Control:

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While You Have the Trucks and the Time... To Put It Where You Want It—When You Need It!

Why risk a public clamor next winter when it's actually more economical to be prepared? By ordering your STERLING ROCK SALT now you can cut handling costs—using your trucks, in slack periods during the next month or so, to distribute supplies to strategic storage points.

Then, when the first snow hits and every truck and every minute counts, you will *not* have to use your equipment to unload shipments—and for long hauls from primary storage to remote areas.

Your trucks and your men are free to start immediately *spreading* salt, not hauling it—removing snow, not driving through it.

No Losses in Storage. STERLING ROCK SALT, with only elementary covering, may be safely stored without loss at as many pickup points as you choose—instantly available to put your plan of attack into operation the minute the storm strikes.

Follow the Lead of the Biggest City and the East's "Snowiest" State. New York City and the State of New Hampshire, each with rugged snow clearance and traffic problems, use decentralized storage and beforehand ordering. Experience has proved the efficiency and economy of a definite pattern of operation, established beforehand—maintained throughout the winter.

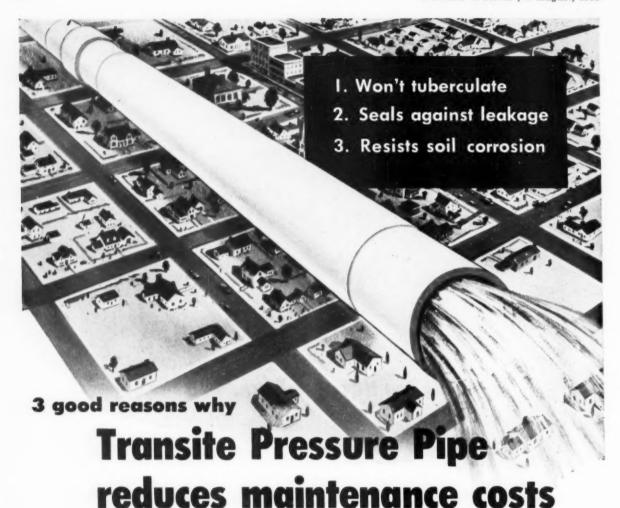
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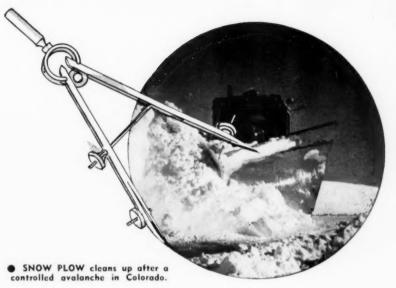
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PUBLIC WORKS Magazine

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Getting Ready For Winter

WINTER is on its way and the highway official who begins to think about it now will be prepared when it does arrive. The problem varies from a comparatively easy one in the South to a very complicated and expensive one in the Northern snow belt. Certain things can be done at this time which will ease the pressure when the wind howls and the snow flies.

Poor drainage can cause extensive damage during the freezing and thawing cycles ahead. Ditches and culverts should be cleaned and the outlets opened so that the water can get away quickly. Shoulders which have been built up along the edge of the pavement should be trimmed with a blade and the excess material removed. If this is not done, water will be held where it can seep under the pavement and do harm. At the same time shoulders should be inspected for weak spots and the necessary new material added. Sections of highway where frost boils have occurred should be corrected by replacing the soil causing the difficulty with granular material

Pavement Repair

New slopes and other graded areas left after construction or maintenance operations should be seeded at this time. Grass sown now has a better chance of survival than it will have if planted at some other season.

All pavements should be in-

spected for holes and weak spots. If cracked and permeable areas are not corrected, water will enter and trouble is sure to result. Paint patching with bituminous material will usually correct the difficulty, and will surely reduce the damage. Holes should be patched and thoroughly sealed to prevent water from entering around the edge of the patch. Untreated roads of gravel, stone, slag, top-soil, etc., should be inspected carefully and weak sections re-inforced by the addition of new material of the same kind as was used in the existing road. Bituminous surfaces which show dry or cracked areas should be retreated. This will revive and seal the surface and prevent damage by infiltration of water during the winter. A tight roof and a dry cellar is a good rule to follow.

This, too, is the time of year to fill cracks and joints in rigid pavements, for two reasons. First this work will prevent water from entering the openings and second the pavement is contracted in cool weather and the joints and cracks will be at their maximum opening. New materials and equipment have been developed in the past few years which make this job more efficient and easier than it used to be.

Ice Control

Chlorides for ice control should be obtained and stored at convenient locations. The same is true of abrasives such as cinders and sand. Chlorides may be used alone or added to the abrasives to prevent freezing. This is the time also to arrange for the production and storage of bituminous winter patching mixtures. These may be manufactured by the local highway forces or may be purchased from bituminous concrete producers.

Snow fences should be inspected and repaired, when necessary and arrangements made for their location and erection before the snow arrives. Paper snow fences have been used in Michigan, on an experimental basis, with apparently satisfactory results.

The cleaning, painting and general overhauling of all equipment, but especially that to be used for snow and ice control, is one of the most important jobs to be done at this time of year. Care and attention now will pay extra dividends when winter comes. The communication system for the control of the operations should also be checked and repaired or changed if necessary. Preliminary preparations should be made for hiring such additional equipment as may be needed. Extra labor should be located and listed so that no time will be lost when the emergency arrives.

To show how other people have successfully handled the snow and ice problem, other articles, describing the operations in various locations, follow.

HOW WE GET "FLORIDA" STREETS IN THE WINTER

FRANK F. HARMON

Commissioner of Public Works, Syracuse, N. Y.

SNOW plowing and ice control are only two of the problems of taking care of winter streets, but they are probably the most important to a community as far as safety and maneuverability are concerned. Of the two, ice is normally the greater hazard, but with the change in design of automobiles, with high-powered motors and much less weight, light snows particularly when wet, can be just as much a hazard as ice. This is particularly so with young drivers because they do not seem to realize the dangers of wet snow as much as they do ice, and therefore are not as careful.

In Syracuse we have many hills and steep grades; and these add to the problems of snow and ice control. Not only is it necessary to control ice and snow conditions quicker where you have a city with a terrain such as ours, but it requires a different type of equipment. This problem has caused us to make extensive studies and experiments, which we feel have resulted in finer and faster snow and ice control for less money.

The perfection that we feel we have reached in Syracuse has not come easily, but through work and the co-operation of equipment and chloride producers. Such cooperation, with suggestions from our own men, and from other Public Works Directors, have brought as near a Florida situation on our streets in the winter time as is humanly possible.

Also, we have been fortunate in having a Mayor who is willing to understand the Department's problems, and a hard-working Common Council, which has taken our problems seriously and has made available moneys to purchase modern and proper equipment to do our work as it should be done.

Syracuse has 396.6 miles of streets that must be plowed and controlled for snow and ice conditions. Some of these streets, like Erie Boulevard and Salina St., which completely cross the City, require for the most part, six passes to remove the snow. Others require five; some

four; and some only two. In all, we estimate that we have 1600 miles of street lanes that must be plowed after each snow storm; and we have allocated our equipment on the basis of five miles an hour effective plowing.

We do not start plowing until there is a minimum of three inches of snow; but we start salting immediately, using nothing but pure Although we had more snow this year up to March 10 than in the previous year, it fell mostly in storms of less than three inches in depth. With our salting program we had very little plowing to do on our heavy traveled highways.

Let me tell you briefly of our organization for handling snow and ice in Syracuse. The Commissioner assumes the responsibility for the



COMMISSIONER Harmon aims for Florida streets during Syracuse winters.

salt—no abrasive. We find abrasives do very little to make driving safe for any great period of time as traffic grinds them up or whips them to the side of the road. Then they are washed into the sewers or lay and make a messy looking street between storms.

Immediately a storm starts, and in some cases when we feel that the storm will break soon, we go into action with our salting equipment and salt until we can determine the extent of the storm. If we decide the storm is going to five, eight, or ten inches, we stop salting and start plowing when three inches of snow have fallen. Salting ahead, or at the beginning, of a snow storm on heavy traveled arterials makes for safer driving and cleaner plowing as the salt keeps the snow from packing.

word to the Superintendent and Foremen to get going, However, the Superintendent and Foremen may do what they feel is necessary in the care of the streets without definite instructions from the Commissioner. This rarely happens, but they would not be criticized for necessary initiative because we constantly meet and discuss our operations and our preparations for operations, and we are all very much of the same mind. I, however, feel that while it is these men's job to take care of the streets, it is the Commissioner's responsibility to make decisions and we have set our work up on that basis.

We subscribe to a weather information service, and also have our local weather service. Weather reports are received in the Commissioner's Office and in our operations office. As soon as it looks like trouble, the Superintendent of Streets, his Assistant, and the Commissioner, go into a huddle and decide what the operation on the predicted storm will be. Every piece of snow fighting equipment or ice control equipment is allocated early in the Fall to foremen and drivers. After we decide we are going out at a given time on ice control or snow plowing, each foreman will instruct his men to prepare and load their equipment for operation at this predetermined time.

We'll assume for instance, that at one o'clock we are notified that a storm, with light snow, freezing rain, and some sleet, will break at 4 o'clock in the afternoon. All of our people are at work throughout the day; therefore the foreman is notified by radio, if he is out in the field, of what is expected, and is directed to be prepared by 3:30 to go into action. This means that at the proper time he will stop whatever he is doing, and send snow fighting and ice control equipment to the Pine Street Garage, where it is loaded and prepared for action.

We have found, in Syracuse, that most of our storms break between 3 and 5 o'clock in the afternoon, so in the winter months we change our regular working hours from 7 AM to 4 PM, to 8 AM to 5 PM, which gives us a full crew up until 5 o'clock to combat any storm. They work through until the 11 PM shift relieves, if needed. This system helps our people get home safely from work.

At one time we had three shifts in the Department, but that has been changed to a day shift and one night shift for street cleaning and snow removal, working from 11 PM to 8 AM. This night shift is in charge of an Assistant Superintendent of Streets who calls the Commissioner and the various foremen when he feels the change in weather is such that all-out operations must be started, and his shift will be unable to handle the expected storm. He also instructs the call-clerk, who is on duty with him, to call the drivers; these in turn call their helpers, as all crews, either ice control or snow plowing are two-man teams.

Due to the laws covering parking, all effective snow plowing must be done between 1 AM and 7 AM when there is supposed to be no parking on any city street. The parking in Syracuse is just as much a handicap to snow plowing as in any other city,



• THIS type of truck-plow unit is most efficient for city snow removal.



SALTING equipment goes into action as soon as a snowstorm starts.



PILING the snow into a center-of-the-street windrow speeds removal.

even though fines have been raised to \$3 for the first offense, \$5 for the second, and \$10 for the third. It is not unusual, however, on a congested street, for this Department to request the Police Department to tow away 50 to 60 cars so that we may do our work.

Ice Control

Controlling of ice requires a faster and more complete coverage than does snow. We therefore have established twenty-nine ice control routes, five of which are top priority routes-main thorofares, fire routes, and hospital routes. These routes are serviced by five large Walter spreaders of approximately seven tons salt capacity; the other twentyfour routes are serviced by smaller trucks with Scotchman spreaders on the rear tailgate of the truck. If it is a freezing rain, these small trucks are supplied with bag-salt, with one driver and one man pouring salt into the spreader.

On flat streets, we salt only at stop lights and stop streets for approximately sixty feet either side of the intersection and let the carry-over take care of the street coming into the intersection the other way. Hills and grades are salted in patches of approximately thirty feet—in other words, salt thirty feet, skip thirty feet, salt thirty feet, cet.—depending on the carry-over to take care of the intervening space.

Each driver is given a pre-determined route sheet for each trip; on this he must check off the intersections of streets as he progresses. These sheets are mimeographed in the early fall and a new sheet used for each storm. No set rule can be established for handling of all storms because of the difference in the individual storms.

One of the worst problems is where sleet and rain fall for say, thirty minutes and are immediately followed by a three or four inches of heavy wet snow in a short period of time. We can, from a cold start, be on our 29 ice control routes in 45 minutes. However, the type of storm I am speaking of here, is of such intensity that driving is hazardous. We, therefore, do not send our equipment out until there is reasonably safe visibility. With this type of storm, we put our Scotchman small rear-end spreaders on our Walter snowplows which are loaded with salt. As the truck plows the snow, a light salting operation is carried on to remove the ice that had formed before the snow started. This method has proved very successful and, of course, is economical in manpower and equipment.

We have nineteen snow plowing routes. These are as evenly divided in work miles as is possible. Practically all of our snow plows and trucks are radio-equipped, but where they are not, each route having two plows to the route, the one not equipped leads the one that is equipped. Then if any complaint, break-down or trouble occurs, immediate help can be sent by the use of the radio-equipped truck.

We have purchased all of our equipment for heavy hauling and flushing with snow plowing in mind. The experiments carried on over the last few years have indicated that one-way nose plows are awkward in cleaning corners and slow and hazardous to operate due to the many manholes and other utilities in the streets. We therefore have purchased all center scraper equipment, mounted on Walter trucks. All of our flushers are the Walter 4-wheel type and the last three purchased were so designed that center scrapers could be used. At the present time, we have available thirty-three of the center scraper type Walter trucks; fifteen of the one-way plows mountable on Walter trucks; one Walter "Sno-Go" Loader; and one Athey Hi-Loader. We also have three old track-type Barber Greene's that we can use in an emergency for loading snow.

In 1950, we decided to plow our main arterials from the curb to the center of the street. This gives us only one large windrow to remove. This system has stepped up our snow removal program materially. We used two road graders, one Austin-Western 4-wheel drive, 4-wheel steer; and one Caterpillar for the windrowing operation. These machines are equipped with wings and are also used for plowing our wider thorofares. We assign twelve trucks to the Walter snow loader and six trucks to the small snow loader for the removal of snow. We are fortunate in having Onondaga Creek only six blocks away. This gives us a short haul.

After all snow is removed from the metropolitan area, if there is any tendency for slippery streets, they immediately receive a light salting to make them safe. If a storm has run its course, by four o'clock in the morning, we will, as a general rule, have the main arterials and metropolitan streets free of all snow and ice by eight in the morning.

Bringing Florida Streets to Syracuse has been the pride of the men in the Department of Public Works. In fact, since the Common Council has made money available for proper snow fighting equipment, it is a pleasurable game among the men who do the work.

If your city wants good snow and ice control you must have the proper equipment. You must know what you want, and why. You must sell your Council and Mayor or City Manager on a factual basis. If they won't listen, go to the people through your newspaper, radio and television. For this you might be fired—but if you cannot do a good job, you don't want your job anyway. However, chances are better than average that you will get what you want, and need.

During the calendar year 1952, we used 4,199 tons of salt and 51 tons of calcium chloride. These cost slightly over \$50,000. Labor costs were near \$29,000, giving a total cost of \$79,394, compared to \$119,-380 in 1951 and \$127,305 in 1950. Snow removed in 1952 totalled 17,-772 cu. yds. compared to 41,829 cu. yds. in 1951.

Mr. Harmon presented this paper before the recent meeting of the Upstate New York Chapter of the American Public Works Assn.

WINTER MAINTENANCE in New Hampshire

THE 1951-1952 winter was about normal in respect to temperature but quite a bit more harsh as to snowfall when compared with the mean temperature and the average snowfall of the past ten winters. The total average snowfall of 106.7 inches for the state was 24.6 inches above the average of the past ten winters, and 50.2 inches above that of the previous winter. November, December, February and March all showed an excess of snowfall over the average for the past ten winters. The storm of February 17 and 18 was especially severe with snowfall varying from 12 inches in the southern part of the state to 30 inches in Crawford Notch. This storm was accompanied by high winds which caused severe drifting both during and following the storm. Monthly temperatures were about normal except for November where the temperature averaged 2.5 degrees below normal.

During this past winter slightly more than two million dollars were (Continued on page 120)

SNOW and ICE CONTROL in UPSTATE NEW YORK

F. Ray Williams, County Superintendent of Highways, Saratoga Co., N. Y.

In upstate New York, about 200 miles from the City of New York, Saratoga County lies in the snow belt. Our average snowfall is from 60 to 120 ins. annually. Many of the snow storms are light—not exceeding 6 ins.; but at times we have storms that pile up 18 to 24 ins. of snow.

There are 218 miles of roads on the State Highway System in this county and 351 miles of county roads, making a total of 569 miles of highways. The responsibility for snow and ice control on this mileage is ours. With this number of miles of highway, it naturally takes a large organization of men and equipment to accomplish an efficient and effective job of snow removal and ice control.

In organizing for this work, we use not only county equipment but much privately owned equipment and some town equipment. Town equipment is used mostly on county roads while county equipment is used on both state highways and county roads, together with a considerable amount of privately owned equipment which is on call at all

times during the winter season for use where necessary.

We stock - pile a considerable amount of abrasives, both at our garage location at Ballston Spa and at our maintenance garage in the Conklingville area. While we use approximately 3000 tons of clear CC Grade rock salt without abrasives, there are times and places where it is necessary to use treated abrasives in order to provide traction at least during storms or until straight chemicals have time to act.

Our organization consists of 8 foremen and approximately 200 men one-half of whom are on call when needed. The available equipment comprises 90 trucks; 9 shovels; 7 bulldozers; 12 power graders; 2 Sno-Go units; about 12 special sanding bodies; 14 salt machines; 75 sand spreaders; 3 belt conveyors; 1 Hydrocrane; and one ½-yard truck crane

The majority of our storms are accompanied by temperatures of 20° to 32°. With the warm temperatures, we start at the beginning of the storm and spread clear CC Grade rock salt at the rate of approxi-



 ROTARY plow is used for widening after pavement has been cleared.

mately 400 lbs. per mile. This is done on the state highway system; and on some county roads where the traffic is heaviest and where equipment is available. With the accompanying warmer temperatures the salt starts to work and keeps the snow as slush. We delay plowing until approximately 4 ins. of snow has fallen and to permit time for the salt to work so that it is possible, when plowing, to clean down to pavement. Plowing is continued until the storm subsides. Another light application of salt is made where there is packed snow left on the pavement. This method has been followed for the last few years and has enabled us to give the traveling public bare roads practically all of the time, except during snow storms.

With temperatures below 20°, we start plowing at about 2 ins. of snow and continue plowing until the storm subsides. When the storm subsides and the plowing is completed, there is usually a thin film of snow left on the pavement. Then the necessary abrasives, mixed with chemicals, are applied, especially on hills and curves to give traction. If the temperature rises within the next day or so, clear rock salt is applied throughout the entire length if necessary. Usually this will clear the thin film of snow, resulting in bare pavement.

During the winter of 1951-52 we had five 2-way radio units installed in our equipment. This worked out so satisfactorily that it was increased to 10 units during the past winter of 1952-53. We now have these 10 units operating in strategic locations so we have communication either from the office or County Garage to our truck equipment op-

(Continued on page 118)



 PLOWING of snow begins when 2 to 4 inches have fallen and is continued until the storm subsides. Salt is used before and after plowing.

SOLVING INDUSTRIAL WASTE DISPOSAL PROBLEMS

in South Dakota

R. J. STAPF, Chief, Sewage Section.

C. E. CARL, Director, Division of Sanitary Engineering,
South Dakota Department of Health

WITH approximately 650,000 peo-ple, South Dakota is primarily an agricultural state with relatively small cities. However, there are 125 municipal sewerage systems. Sewage treatment plants in these small communities, designed to handle ordinary domestic sewage, are subject to quite severe shock loadings from small industries. Such industries are typical of those found in an agricultural area and include milk processing plants, creameries and packing houses. Some industrial establishments treat their own wastes, including a sugar beet plant, a lithium mineral concentrating plant, and a hog-killing plant; while some industries are cooperating with cities on municipal sewage works construction and operation.

The waters in the state are subject to many uses, consequently, relatively stable sewage effluents are required if maximum benefits are to be assured from the somewhat limited water resources. Consequently, an active interest has always been shown towards adequate sewage treatment facilities and that interest has increased in recent years.

During 1950-51-52, culmination of the work of previous years was realized in the completion of new municipal and industrial waste treatment facilities. Five industrial improvements, either individually or collectively with the municipality concerned, representing five different types of industries, are discussed here individually.

The Lithium Corporation of America in 1951 started a lithium mineral concentrating plant in the Black Hills near Hill City, South Dakota. The concentrator is a flotation plant capable of processing 150 tons of ore per twenty-four day. The process involves dry crushing of mine-run rock (pegmatites); wet grinding to fine sand; light scouring with caustic soda to loosen slimes (clay fraction); washing: collecting with hydro-carbon oil (oleic acid); floating with an alcohol frother; filtering; and drying the concentrates. pH control is maintained with dilute sulphuric acid. The industry's waste problem at this particular installation consists primarily of disposing of mill tailings.

Domestic water supply is from a drilled well, through a pressure system. The industrial water supply is taken from Spring Creek and approximately 175 gpm. Domestic wastes are treated in a septic tank and a tile absorption field. Industrial wastes are lagooned with overflow from the last lagoon entering Spring Creek above the source of the plant industrial water supply.

F.oor wastes are discharged to a small lagoon near the plant. The mill tailings, comprised of wash water, waste sands, and slime fraction, are pumped 1700 feet horizontally and 200 feet vertically through 4-inch OD pipe with two-stage pumping to the site of the primary



FINAL clarifier lagoon for the Lithium Corp. mineral concentrating plant. Treatment process prevents carry-over of sand and/or slime.

lagoons. At the location of the second pump there is an additional lagoon for drainage of the discharge line if it is necessary to shut this pump down for repairs.

At the outlet of the pump discharge line the wastes are discharged in a 7-foot Callow sand cone. The underflow, about 40% solids, goes to the sand lagoon; the overflow, including most of the slime (clavey fraction) and fine sand, goes to the slime lagoon. The slime lagoon has nearly an acre of surface area and a water depth of four to five feet. Very little pool is maintained in the sand lagoon as this is an overflow structure and the water moves on through as soon as the sand has settled. Down hill from these two lagoons is a reserve lagoon covering two acres and maintaining an 8- to 10-foot depth of water. The overflow from this lagoon is back to Spring Creek.

This plant has been in operation approximately one year and frequent observations have failed to reveal any carry-over of sand, slime or other material from the lagoons to the Creek.

Packing Plant

The municipal sewage treatment plant at Madison. South Dakota had been handling all of the domestic and industrial wastes for the community. The wastes discharged from the plant to a stream flowing from Lake Herman, upstream from the City, to Lake Madison, approximately 3 miles downstream. The Madison sewage treatment plant in recent

years became outmoded and tremendously overloaded, resulting in very unsatisfactory downstream conditions. The deterioration was of such a nature that a land owner filed suit against the city for loss of cattle in early 1951. At that time the outlook for any improvements to the sewage works was quite dim as an \$85,000 bond issue for such improvements was defeated in March, 1951.

In response to complaints from land owners and a request from the city officials, the South Dakota Department of Health made a sanitary survey of the city sewage works in May, 1951, and a report, with recommendations for corrections, was submitted to the City officials on July 29. A survey of industrial wastes was included and industries concerned were notified of this report on the same day copies were transmitted to the City.

At the time of the 1951 survey the Madison population was 5142; the average sewage flow was 1.4 mgd, while the night flows were 0.5 mgd. indicative of considerable infiltration; the total BOD entering the plant was 2232 lbs. per day compared to an estimated domestic load of from 800-1000 lbs. per day; and suspended solids averaged 1228 lbs.

The primary source of industrial wastes was Roberts and Oake Packing Company, primarily a hog slaughtering plant. The average kill was 300-650 hogs per day. The water consumption was about 200,000 gallons per day, and the waste

treatment consisted of a threecompartment grease trap-15 ft. x 2 ft. x 3 ft. deep. Other sources of industrial wastes included a poultry processing plant, killing about 2000 lbs, of poultry per week, with a water consumption averaging 1.7 million gallons per month; and a creamery, processing about a million lbs. of butter annually, but which dried all buttermilk.

The City retained consultants to study the sewerage problem in more detail and to attempt an equitable financial agreement between industry and the City for building and operating a new sewage works. After several months of negotiations, it was concluded that the City would build their own plant and the Roberts and Oake Company would construct their own plant.

Officials of Roberts and Oake, Inc. consulted with the State Department of Health concerning the degree of treatment that would be needed and thereafter retained as consultants Bulkley, Dunton Pulp Company, Inc. who proposed their Colloidair system for primary treatment, followed by a conventional secondary treatment of filtration, secondary settling and provision for re-circulation. The following basis of design was used for this industrial waste plant:

Average kill for a six-day week 650 hogs per day; and design flow 288,000 gallons per 12-hour day.

The following units were proposed to be included: A rotary screen for solids removal (this unit was already on hand); Colloidair-





PULP silo storage at sugar beet plant; drained TREATMENT for creamery plant includes trickling filter with high protective wall and Imhoff tank.

primary treatment of 400 gpm design capacity but able to handle up to 480 gpm.

Chemical flocculation and forced air flotation will be employed in the Colloidair separator. Solids will be recovered for disposal as inedible grease and cracklings. It is claimed that the BOD reduction in this unit will average 75 percent; however, the secondary section design was tentatively based on only a 50 percent BOD reduction through the primary. Other units will include:

A standard rate trickling filter with additional forced air injection if needed. The filter will be surrounded by a 7 ft. high wall to aid in the prevention of freezing. The filter will be 80 ft. in diameter by 6 ft. in depth. The final settling tank will have 8800 cubic feet capacity, with a windbreak. Sludge from this tank will be discharged to the city sanitary sewer system. Pumps are provided for re-circulation and where installed are in duplicate. Sanitary sewage from the plant will be discharged to the sanitary sewer system of the city.

As this is being written, the Colloidair unit has just been placed in operation. Laboratory determinations will be made to determine the efficiency of this unit prior to completion of the rest of the plant, enabling the owners to change the secondary units if necessary.

The city passed a \$350,000 bond issue to rebuild their sewage treatment plant and to make some improvements to their municipal waterworks. Plans for the municipal plant construction are being prepared at this time.

Sugar Beet Plant

The South Dakota plant of the Utah and Idaho Sugar Company is located about a mile east of Belle Fourche. Sugar beets for the plant are grown in the irrigated areas of the Belle Fourche Irrigation project in South Dakota with some additional beets being shipped in from northwestern Nebraska. The principal source of water for the Belle Fourche Irrigation Preject is Orman Reservoir and this reservoir is supplied by a canal from the Belle Fourche River. The supply canal starts at a diversion dam on the Belle Fourche River, the dam being located opposite the sugar beet plant. During periods of low stream flow in the fall and winter all water from the Belle Fourche River is diverted to Orman Reservoir but the flow in the river downstream from the dam recovers from springs and running streams.

The plant was built in 1927 and originally all wastes were discharged direct to the river. The river became grossly polluted during processing operations and a program of improvement has been undertaken in an effort to eliminate unsatisfactory river conditions.

This installation normally has a 45- to 60-day operating season, starting between the first and the middle of October. The operating capacity is 1700 tons of sugar beets per day and during the 1952 season approximately 96,0000 tons of beets were processed. Once the campaign starts, the plant operates on a 24-hour basis until the last beets are processed.



 SOME ponding occurs, but the trickling filter operates well.

Water Supply.—Domestic water for the plant is obtained from the City of Belle Fourche municipal water supply. Plant process water is obtained through an open ditch from the Redwater River, a tributary stream to the Belle Fourche River. It is estimated that the total water consumption at the factory is approximately 4500 gallons per minute.

Sewage and Industrial Wastes.— Sanitary sewage from the approximately 200 employees at the plant during the active campaign is treated in a septic tank and the effluent discharged to the main plant sewer.

There are several types of waste from the processing operations and these will be discussed individually:

Lime Wastes.—Lime wastes from the processing operations are discharged to a lagoon. The lime waste lagoon is constructed in such a manner that ordinarily no overflow water escapes. During the 1952 campaign, with a record run of beets, the lime lagoon could not handle all the lime wastes; consequently, some of the lime wastes were discharged to a ditch surrounding the pulp silo drainage lagoon. When this was filled, the lime wastes were discharged to the ground surface, but no lime wastes reached the river.

Flume and Wash Water.-Flume water is used to convey beets into the factory from beet storage piles or car dumping platforms. Trash and rock catchers placed in the flume remove much of the leaves and rocks which are carried with the beets and the flume water removes considerable quantities of mud and other foreign material attached to the beets. Remaining dirt is removed in a beet washer and it is estimated that 30 to 45 lbs. of dirt are removed per ton of beets handled. Added to this dirt will be the organic material removed from the beets by physical contact and the spoiled beets which are thrown out. It is estimated that approximately 3000 gallons per minute are used for flume and wash water.

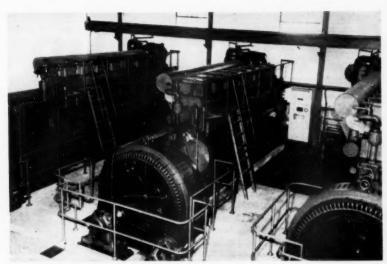
Wash and flume water is ordinarily considered the weakest waste from the sugar plant but it has the greatest volume. These wastes are discharged to the main plant sewer and then to a series of settling ponds. The total area of these ponds is about 21 acres and the average water depth is 31/2 to 4 feet. The overflow discharge from the last pond was formerly direct to the Belle Fourche River immediately upstream from the diversion dam. When water was being diverted from the Belle Fourche River to the Orman Reservoir, these wastes were included in the diverted water. In 1952 the settling pond overflow line was changed to divert the wastes to the Belle Fourche River downstream from the dan, thereby removing that industrial waste from the Orman Reservoir.

Pulp Screen Water Wastes.—Pulp screen water wastes amount to about 500 gallons of water per minute and represents the water left in the beets after practically all the sugar has been extracted. These wastes are discharged to the main plant sewer.

(Continued on page 127)



 ENTRANCE to the Tarboro power plant.



• BULK OF the power load is carried by three 1600-hp diesels shown here.

TARBORO Cuts Power Costs by Using Heavy Fuel Oil

R. M. WEATHERLY,

Manager, Municipal Light & Power
System, Tarboro, No. Carolina

PERATION of three Worthington diesel generator units on heavy #5 fuel oil instead of more expensive light diesel fuel has reduced per-kilowatt fuel costs by approximately 34 percent for the Tarboro, N. C., Municipal Light and Power System. Supplying the community of 8,000 people and its dozen small industries with an energy output that has already reached 3550 KW, this plant has been one of the pioneers in the burning of heavy fuels.

At the time the latest plant expansion was being planned in 1949, the high cost of light diesel fuel led city officials and engineering consultants to select engines capable of burning a cheaper, heavier oil and to design a fuel system for efficient handling of the heavy fuel. The fuel now in use has an API gravity of 15.5, viscosity S.U. 250 at 100°F., sulphur 1.59 and ash .04.

Because of the fact that the heavy fuels are not sufficiently volatile to enable their use until after the engines have been started and are thoroughly warmed up, a dual fuel system has been necessary. Providing light oil for starting purposes, this dual system insures reliable operation regardless of auxiliary equipment failure or the unavailability of any given type of fuel oil. Outdoor storage facilities consist of one large tank with a capacity of 120,000 gallons of #5 fuel oil and three smaller light oil tanks with a total capacity of 36,000 gallons.

The fuel system permits the operator to use either of the two fuels or any combination of them. Actually, there are two complete fuel oil systems which merge at the engine selection valves. By setting these valves, the engines can be run off either system.

At present, the plant uses a No. 2 oil in the light oil system and employs it for starting and stopping the Worthington engines and at times for regular operation. In the heavy oil system, the plant uses No. 5 fuel oil without blending and the blending tank in effect serves as a day tank for non-centrifuged fuel. Centrifuging removes an average of four pounds of solid material per thousand gallons. Since excess oil pumped into the second day tank returns to the blending tank, it again passes through the centrifuge with a consequent increase in solids

The higher heating value per gallon of the heavy fuel oils, combined with the lower cost per gallon, will undoubtedly mean future additional units will be designed to use such fuels. While additional problems, over and above the normal fuel problems, are admittedly present, their solution is being achieved. Most problems revolve around the fact that the higher solids content of the heavy fuel imposes additional filtration problems and also places a heavy load on the injector pumps. Cylinder liner wear is also somewhat increased.

Many of these problems have been solved by centrifuging and the use of both edge type and cotton filters on the fuel type. Chromium plated piston rings, now almost standard in automotive practice, are used in the two top grooves of each piston in one engine and show promise of maintaining compression and reducing oil consumption for long periods. Their use may be extended to the other two cagines.

Also sure to be continued is the policy of purchasing engines that can use natural or manufactured gas as fuel. The present engines are so designed and, while natural gas is not now available, the low cost of this fuel is so attractive as to preclude anything other than a dual-fuel engine, so that Tarboro can take immediate advantage of

(Continued on page 120)

PORTLAND BUILDS

GUY BROWNING ARTHUR

OST cities would be content with Portland's three conduits which have a combined capacity of 149,000,000 gallons per day and serve approximately 400,000 people. But Portland, in Oregon, looked over its growing demand for water, and elected to build a new conduit. This starts with 10 miles of 66-inch welded steel pipe at the headworks, and continues with 15½ miles of 56-inch welded pipe to the reservoirs on Mt. Tabor. This will be one of the longest welded steel lines of such size in service.

The contract was let in March, 1952, to Kuckenberg Construction Company, of Portland, at \$4,975,-675.98, the lowest of seven bids ranging up to \$8,903,362.86. The contract required a start within 15 days, and completion by June 15, 1953, with a premium or penalty of \$300 a day for the completion of the job before or after that date.

A subcontract for making the pipe was awarded to Beall Pipe & Tank Corporation, of Portland, and a sub-sub-contract to Pacific Pipe Line Construction Company, of Montebello, California, for treating and wrapping the sections. It was decided to make the sections 70 ft. long, which is a record venture. But Beall Pipe & Tank had the rolls, and is expert in handling thick plate. Also it had the welding machines for automatic continuous welds on both outside and inside of the pipe. Nevertheless it is worth a visit to see the 3s-inch plate succumb to slow, precise rolling that brings its two edges together to form a perfect circle.

After welding, the pipe is subjected to exacting tests in the shop. It must stand a hydrostatic test of 200 psi, and while it is under this pressure it must withstand blows with a 2-pound hammer at 6-inch intervals on both sides of welded joints for the full length of the pipe. Any section showing more than one leak for each 5 ft. of welded seam, or more than 2.5 percent of the total length of welded seam, is rejected. Leaks may not be caulked. Sections showing less than the



• PIPE IS lowered into trench with tractor and pipe layer sideboom.



• FINISHED pipe in trench, jointed and ready for the backfilling job.

minimum number of leaks may be repaired by chipping the weld and rewelding by hand, and then going through the tests again. Special connections are tested with soapsuds at an air pressure of 40 psi.

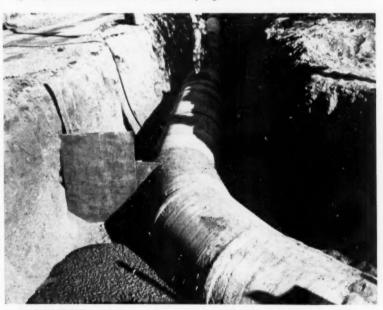
Precautions against corrosion are

now standard practice, but they are impressive, nonetheless. The steel "shall be carefully protected from rust from the time of its manufacture until the pipe is coated." "Cleaning of interior and exterior surfaces shall be done to bright

A NEW PIPE LINE



• TIGHTENING bolts on Dresser coupling; bituminous treatment is next.



CONCRETE is being poured at a bend to take up thrust that may occur.

metal with steel grit or steel shot." The coating is coal tar enamel inside and out, and bonded asbestos—12.5 to 15.5 lbs. per square yard—on the outside. The contractor must provide recording thermometers on the heating kettles, and the charts

are the basis for accepting or rejecting any of the enamel. It is applied to the inside of the pipe according to AWWA specifications. Following the asbestos wrap a final white-wash coating is applied.

The conduit now being built, No.

4, is located on the line of old No. 1 for about 40,000 ft., and that much of the old conduit is being taken up and disposed of by the contractor. For most of the distance the location is along thoroughfares, and the digging is easy. Clearing and grubbing are necessary on about two miles, cutting back to a 40-ft. width. Solid rock excavation and soft digging, together with backfilling, amount to 315,000 cu. yds.

Organizing the Work

Kuckenberg Construction Company was able to organize quickly to undertake the job, with excellent equipment such as a Model 6 trench hoe, 2 25s, and one 80, made by Northwest. Also one 80 dragline, one clam shell, and two 20 Bucyrus draglines. Besides these standard items the Kuckenberg Company has developed a unique and highly successful side-dump 10-yard truck which is going through tough tests on this job. The problem of getting the dump-gate full-open in time to let the load slide through has been solved.

The top third of the gate swings open with the tilting of the truck. The lower two-thirds is swung open and down, quickly, as the load begins to slide out, and forms a skid platform over which the dirt is delivered well away from the truck body. The truck is built for Kuckenberg by the Schetky Equipment Corporation, of Portland.

The spectcular work is done by a Caterpiller Diesel Tractor fitted with Trackson MDW 8 pipe layer sideboom. Sometimes even this competent machine has to get a lift on the other end of a bucking 20,000-lb, section of pipe from another truck crane.

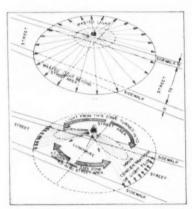
The first pipe was delivered last August, 2500 feet; in September 5000 ft.; in October and November, 21,000 ft. each. Since that time, except for January, about 1000 ft. have been delivered each day. Not more than 1500 ft. may be distributed along the job beyond that already laid in the trench—a limit in the specifications, so deliveries must be keyed to pipe laying.

On the Northwest Coast rainfall (Continued on page 142)

The Use of Refractors in Street Lighting

THERE are many factors to be considered in the overall task of planning a street lighting installation. It is helpful if the planner thinks in terms of the optical assembly and light source. From an illumination standpoint, these are the most important parts of any street lighting system because they put the light on the street.

The light source may be an incandescent filament, mercury vapor lamp or other type of lamp. The optical assembly is designed to control the distribution of that light so that it will be directed to the street and sidewalks in the proper amounts at the right places. By the use of prisms formed on the inside surface of glass enclosures for luminaires, the distribution of light is efficiently and effectively controlled. Three basic types of prisms are incorporated in Holophane refractors: refracting prisms, which bend transmitted light rays; reflecting prisms, which return light rays into the luminaire; and diffusing prisms which scatter transmitted



HOW TYPE III refractor concentrates light on street areas.

light. Many modifications and combinations of these prisms are used to produce the exact vertical and lateral light distributions required to shape the light to the street or area to be illuminated. Typical distributions are shown in the accompanying diagrams.

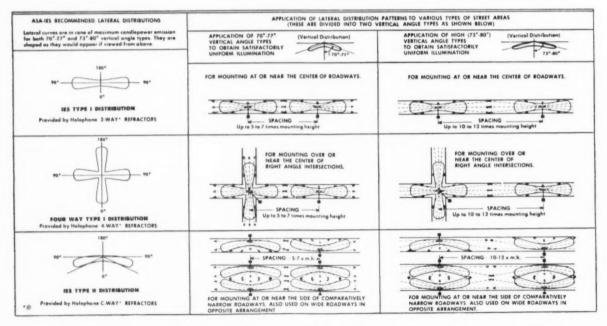
As a first step in planning street lighting, it is desirable to determine the most hazardous areas based on accident and crime statistics, so that improvements can be made first in these places where the need is greatest.

Planned Lighting Procedure

Next, the required illumination levels are determined. These vary according to vehicular and pedestrian traffic volumes. Minimum recommended average footcandles for lighting streets, express highways and thruways range from 0.2 ft-c for light pedestrian traffic and very light vehicular traffic (0-150 vehicles per hour) to 1.2 ft-c for heavy pedestrian traffic and over 1200 vehicles per hour. Where both vehicle and pedestrian traffic is medium, 0.4 ft-c is recommended. For highways, 0.3 ft-c should be provided. Highway intersections. circles, cloverleafs, etc. should have 0.4 ft-c. For two-street intersections in urban areas the illumination level should equal the sum of the levels of the streets forming the intersection.

In business areas it is desirable to provide illumination above minimum levels. Other factors involved are possible future increases in traffic; pavement reflection characteristics, which may require higher illumination values; and a maintenance factor to allow for de-

(Continued on page 84)



Aerial Photography Pays off In Maryland

WILLIAM F. CHILDS, JR., Chief Engineer, Maryland State Roads Commission

WE in Maryland have utilized aerial photography extensively in our location studies. We find that the chief advantages are: (1) The ability to gather detailed topographic information without divulging proposed locations and with a minimum disturbance to local communities. (2) The saving in time. since comparable or superior information may be obtained by aerial means in one-tenth the time required by ground surveys. (3) Manpower savings in these days of severe engineering personnel shortages. (4) Important money savings. with costs appoximately one-fifth of conventional ground survey method costs. (5) The additional width of coverage generally obtained from aerial photography is of great value to the designer for drainage and other features after the map has served its primary location purpose.

Maryland extends from the Atlantic Ocean on the east, with its flat coastal plain, up through the Piedmont Plateau to the Allegheny Mountains in the west. This varying topography calls for different types of aerial development. For instance, on the flat Eastern Shore, contours would not serve a very useful purpose so we obtain photographic mosaics only. In the plateau area, care is taken to obtain topographic maps with scales and contour intervals selected in such a manner that adequate coverage will be obtained at the lowest possible cost. In the mountains of the western part of the state, contour interval is probably the most important item governing the selection of suitable coverage.

Types of Projects

Chesapeake Bay Bridge to Warwick.—This project is through relatively flat terrain where drainage features, property patterns and community location were the prime factors in the selection of the aerial development. An aerial mosaic 45 miles long and approximately 2 miles wide, at a scale of 1 inch equals 400 feet, was developed at a cost of \$3,766.50—an average cost of about $4\frac{1}{2}$ cents per acre.

Atlantic Coast, Ocean City to Delaware.-For beach erosion control studies, a flight was made last October and it is intended to have a similar flight made each October hereafter for purposes of comparison and the study of erosion characteristics. Individual photographs at a scale of 1 inch equals 200 ft. and mosaics at a scale of 1 inch equals 400 ft. were developed from a low altitude flight. The pictures cover approximately 4,000 ft. in width and extend a distance of 9.5 miles. Total cost was \$1,536.00 or \$0.33 per acre.

Baltimore City Circumferential.

—In order to expedite the work of development, as well as to protect the location from land speculators, a complete aerial photogrammetric development was contracted for. Controlled mosaics at a scale of 1 inch equals 400 ft. and a topographic strip map varying in width from 2,000 to 3,000 ft. was obtained. Contour intervals of 2 ft. were used in areas where interchanges were to be developed and on the remainder of the map 5-foot contours were

shown. Total cost of the aerial survey work was \$56,843.39, or roughly \$3.30 per acre.

U. S. Route 40.—This route traverses some of the roughest terrain in the State, crossing four major mountains. The project is approximately 24 miles long and is mentioned here because of the use of contoured photographs which is an unusual method of development. A strip approximately 3 miles wide was flown and photographs at a scale of 1 inch equals 200 ft. were contoured by photogrammetric methods. As the main problem on this project was that of grades, these contoured photographs were used in the development of profiles and the selection of an area 1,500 ft. wide for strip map development. A strip map at a scale of 1 inch equals 200 ft. with 5-foot contour intervals was the final stage of the aerial development. Total cost of this project was \$26,822.50 or approximately \$1.79 per acre.

Conclusions

Highway engineers must not only understand the possibilities of photogrammetry, but its limitations as



 MOSAIC of a section of the Eastern Shore shows a flat terrain where drainage features, property patterns and community location were important.

well. Conventional photogrammetric methods must be properly combined with conventional ground survey practices and the best combination selected to meet the particular problem. Photogrammetric mapping should be tied into highways, which in turn should be tied into the State Coordinate System. Control points should be well established, stand out prominently and be photographically identifiable, such as road intersections, property corners, fence line intersections, and the like.

For wide coverage it may be more economical to prepare a preliminary map to a scale of 1 inch equals 400 ft. with 10-foot contours followed by a larger scale map covering a narrow strip.

Aerial contour mapping is not suitable to a road-widening project and has its greatest usefulness and engineering value on entirely new locations.

For complex facilities, such as urban developments and interchange areas, a 50-foot scale and 2-foot contours may be found desirable; while in less complex cases, as in

rural or undeveloped areas, a 100-foot scale and 5-foot contours may be sufficient. A desirable vertical accuracy is that 90 percent of contours shall be within one-half of a contour interval and all within a contour interval. The desirable horizontal accuracy is one-twentieth to one-fiftieth of the horizontal scale. The spacing of monuments will depend largely upon the development within the area—probably 1,000 ft. to 2,000 ft. in urban areas and half a mile in rural and undeveloped areas.

The flight elevations used in Maryland have been: Low, 400 ft.; highest, 14,000; and generally 2,000 to 6,000 ft. For highway purposes, flights should be made in seasons of no foliage; and generally from one hour before to one or two hours after noon, at which times shadows and reflections are at a minimum.

This article is based on a paper presented by Mr. Childs at the March meeting of the Association of State Highway Officials of the North Atlantic States, which was held in Atlantic City.



Photos Courtery Asra Service Corn

 Beach erosion control studies are facilitated by aerial photographs. Flights and photos may be made once a year and conditions compared.

Street Lighting

(Continued from page 82)

creased light output due to normal lamp depreciation and dirt accumulation.

Location of Luminaires

All luminaires are designed for definite spacing to mounting height ratios. Longer and more economical spacings are possible by using higher mountings and larger lamp sizes. For mountings near the center of roadways and for four-way distribution. the recommended mounting height is 25 ft. Mounting heights from 20 to 30 ft, are used for lights located at or near the sides of roadways. The required lateral and vertical light distribution for various mounting heights and positions may be provided by the use of suitable refractors.

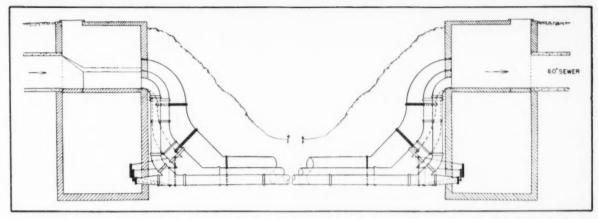
At intersections, luminaires should be located along normal lines of sight beyond the intersection and beyond pedestrian crosswalks. If a staggered arrangement is normally used, the "far right" location of luminaires should first be established at intersections. Where opposite spacing is used along the roadway, the same arrangement should be used at intersections. Where a street ends at its intersection with a cross street, a luminaire should be located on the cross street opposite the dead end.

Curves require no more illumination than comparable straight areas, but luminaire locations are important. Luminaires should be placed along the outsides of curves to furnish the proper brightness pattern, and spacings should be such that the second luminaire ahead of the motorist will always be visible along his normal line of sight.

An outline for planned street lighting procedure is presented in greater detail in literature of The Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y. In addition to the material covered in this article, other special cases are discussed and methods of computing lamp size required are provided.

Fast Work on Water Taps

Using a Hayes Model B, two men have made up to 3734-inch taps in an 8-hour day, according to E. R. Jones, Distribution Sup't., Water Works Department, West Des Moines, Ia.



• CROSS-sectional view, not to scale, showing how the three inverted siphons carry sewage under Expressway.

SIPHONS

Carry Sewage Under Expressway

NUMBER of sewer siphons are A being constructed in conjunction with the building of Chicago's "Congress Street Expressway". This Expressway starts at the lake front and extends eight miles straight west through the heart of Chicago. It is a new depressed thoroughfare designed to speed traffic from the Loop District to the Western Suburbs. The major north and south streets will pass over the new expressway on bridges and the secondary streets will be connected at the right-of-way lines to the service drives. The Expressway width ranges from 326 feet to 465 feet and the average depression below the normal street line is about 14 feet.

At each intersection between the Expressway and existing streets, all of the sub-surface utilities, such as sewers, water mains, gas mains, electric ducts, telephone ducts, etc., have to be relocated. The method of rearranging the large sewers is of special interest because all of them will have to be relocated at a lower elevation; and in many cases they will have to be moved 40 or 50 feet either east or west of their present location. The lateral shift is necessary in order to allow room for the construction of present or future bridges over the new Expressway. During relocation, the sewers must be kept in service at all times.

The lowering of the water and gas mains, as well as the various duct systems, is comparatively simple when compared with the sewers. D. W. JOHNSON

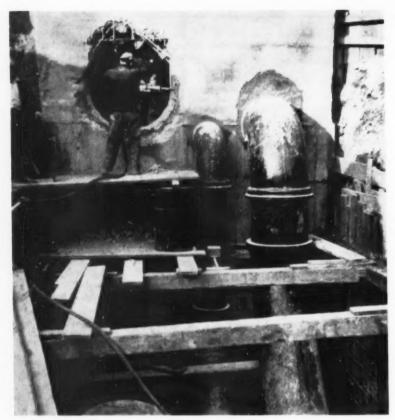
which are of the combined type, designed to carry both domestic sewage and storm water run off. Practically all of them run north-south and are at right angles to the Expressway. Diameters are generally 60 ins, or more and they are fully loaded only during periods of heavy rainfall; for the balance of the time they operate at a small fraction of their normal capacity, with a flow 8 to 12 inches in depth. Inverted siphons are necessary to carry these large sewers under the new street; and because of the variation in flow, design is complicated.

The changes that are required for the existing 60-inch sewer flowing north on Wood Street is a typical example of the design and methods used. This brick sewer, constructed many years ago, had to be lowered 14.4 feet at this street intersection for a distance of 391.3 feet; and also gradually for about 50 feet at each end to return the sewer to its original flow line. At the same time in order to provide space for a bridge and bridge footings to carry the North and South side street, the sewer was also moved 50 feet to the east. Two concrete junction boxes approximately 14 feet square and 27 feet deep in relation to the old street level were constructed at the North and South right-of-way lines of the

Expressway. These were built with two rooms or compartments, one above the other with a water-tight floor between, and with a suitable water-tight manhole for access to the lower compartment. The 391.3foot section of sewer between the two concrete vaults is the critical section because it is 14.4 feet below the normal grade line. In the siphon, three pipes of different diameter were used. The smallest pipe is 16 inches in diameter and is of cast iron pipe and fittings. This siphon will be in constant operation all of the time inasmuch as it carries all normal dry-weather sewage flow which is diverted into it by means of a baffle plate in the inlet chamber. The second sewer siphon is 30 inches in diameter, with all of the fittings being of cast iron and the pipe of concrete. The third sewer siphon is 48 inches in diameter and again the fittings are of cast iron and the pipe is of concrete.

Siphon Flow Arrangement

The floor of the upper compartment of the inlet vault is at the flow line of the incoming sewer. A weir extending 2.52 ft. above this floor directs all of the flow through the 16-inch sewer. If the depth of the incoming sewage exceeds 2.52 ft. above the floor, it overflows the weir, and the 30-inch line comes into action. These two siphons carry the load until the sewage rises to a depth of 3 feet above the floor, at which point it overflows a second



• INSTALLING inverted siphons; 16 and 30-in. in place; 48-in. under way.

weir plate and the 48-inch line comes into use. This will only occur at times of a heavy rainfall.

In the design, the velocity in each of the siphons is maintained at 3 feet per second or better, which experience has shown to be sufficient to carry grit and solids through the siphon, up the leg on the down stream side, and back into the original sewer. However, unusual objects and forms of debris get into the storm sewers from time to time and provisions are made for the rodding of all three of these siphons by the use of the second compartment of the vault which is at the lower elevation. Each end of the siphons are provided with a wye fitting and a removable flange so that in case of stoppage of any of the lines, the flange at each end of the line can be taken off and the debris rodded out or flushed out with a fire hose.

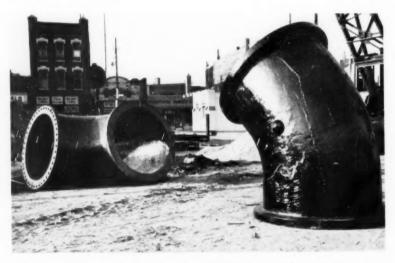
The three siphons between the two concrete vaults were laid in the same trench with the inverts at the same elevation. Below these three siphons was placed a 12-inch vitrified drain tile. The whole trench was backfilled with torpedo sand.

The 12-inch vitrified drain was installed to take care of any leakage that might occur in the joints of the two larger siphons. Because of the tightness of the clay soil, such leakage could soften the subgrade under the finished paved street surface, thus resulting in a pavement failure,

The vitrified tile was connected into the general drain system of the Expressway which is laid at a lower elevation.

This method of relocating sewers to accommodate new construction is common practice in Chicago. Such siphons have been in use for many years, and there is a number of such installations over the city especially under the river. Some of these are 80 to 90 feet below the ground line. The contract covering the Wood Street work amounted to approximately \$200,000 and was performed by L. Scully & Sons. The work has been completed and the sewer is in operation in its new location. This three-mile section, of the eight miles of Expressway, is under the jurisdiction of the IIlinois State Highway Department.

The Congress Street Expressway is a part of the general Chicago plan for a 67-mile system of Super-Highways to serve the metropolitan area. These will cost over \$446,000,-000 and will require several years for completion. The cost of construction for this system of highways is being borne jointly by the city of Chicago, by Cook County, and by the Illinois State Department of Highways, along with funds made available by the Federal Bureau of Public Roads. Work on the entire system could not be undertaken at one time, but work has been going on for two years on the Congress Street Expressway on which a large number of sewer siphons, as mentioned earlier in the article, have been and are being installed. This eight miles of Expressway is scheduled for completion in 1955.



• CAST IRON elbows, 48-inch, 90 and 45-degree, ready to be installed.



PAT THOMSON.

County Engineer, Waterville, Wash.

PROPER public relations are an essential part of good county departmental management. The public is entitled to know how its moneys are expended and their distribution.

An irate taxpayer stormed into a County Engineer's office demanding the immediate construction of a certain item—or else. His crowning, crushing statement, delivered under the leverage of a violently waving arm, was "I pay \$— taxes and should have better road service for that amount of money."

A resultant calm study of this man's tax situation startled both parties. The County Engineer was astounded at the abysmal ignorance of the taxpayer in the distribution of his tax dollar. The taxpayer was astounded because the County Road department, which he felt received all of his funds, actually got only 15.1 percent of the tax funds collected in that district. He did not know which other county departments received a share of his tax funds nor how much the share amounted to. He was not acquainted with, in fact had never

County Tax Structure Clarified by Public Relations

heard of, the mandatory tax levies. The taxpayer left the office satisfied, and feeling that for the percentage of his funds invested in roads he was getting value received.

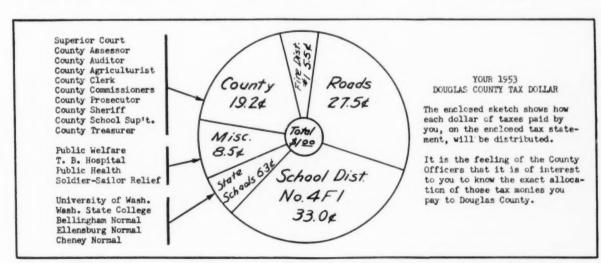
The County Engineer was not satisfied, however, for in checking with other county offices it was found this unpleasant scene occurred quite frequently. Through a quick local check, it was found the average taxpayer was almost wholly ignorant of the distribution of his tax dollar and the legal uses to which it must be put.

The whipping boy of the entire county tax structure appeared to be the County Assessor. He has become the keystone of the financial structure of local government. Under Washington laws, legislation limits taxation to forty (40) mills of the assessed valuation. So the County Assessor has actually become budget officer, instead of appraisal officer as his position was originally intended to be.

Discussion of the matter brought about the decision that tax levying responsibility should be placed equally upon all the tax receiving organizations. Let the special levy enthusiasts—fire districts, hospital and library districts, school districts—and all tax levying county bodies justly shoulder the tax bur-

den responsibility. So a joint project of public relations was established using the pie graph based on percentage of tax dollar distribution to various organizations. The calculations of the tax distribution per tax district were accomplished by the Assessor's Office. Drafting and printing of forms was done by the County Engineer's Office. The forms were segregated and attached to the proper tax statements for mailing by the County Treasurer's office.

Thus far, some five thousand tax distribution graphs have been mailed out to individual tax payers, covering 45 taxing districts. Results have been immediate and gratifying. People have stopped in of their own accord to discuss the tax situation sanely and judiciously. There has been a greater county wide understanding of the problems confronting the public officials. Attitudes have changed from that of condemnation to willingness and helpfulness toward a general solution. The local tax problem is no longer a back breaking problem for public officials to battle alone, but has become a shared problem. For we have found that the public is willing and able to help and understand the problem, if they are made aware that help is necessary.



PORTABLE SHELTERS PERMIT WINTER RESERVOIR CONSTRUCTION

BY utilizing eight portable buildings as shelters, the Minneapolis Water Department was able to carry on concreting work throughout the winter of 1952-53. A new reservoir is under construction which will have a capacity of 20 million gallons. It is to be 538 ft. long, 273 ft. wide and up to 24 ft. deep. Construction involved 11,240 cu. yds. of reinforced concrete. The short open construction season, coupled with the need for the reservoir, made winter construction imperative.

As a protection against the weather, portable coverings were constructed. There were four pairs or sets, with one large and one small building in each set. The two structures in a set were moved from place to place on the job at the same time, using a tractor or crane. The structures were carried by 6-inch dolly wheels running on planks.

Details of Shelters

At first, wooden frameworks covered by tarpaulins were used. The heat loss from these was so great that a tight covering was deemed necessary, and the frameworks were covered with Masonite Presdwood, 3/16 inch thick. The panels used were 4 ft. by 8 ft., and these panels were attached to the framework with two-headed nails for easy dismantling. The framework was of 2-in. by 6-in. material, 4 ft. on centers, with headers every 4 ft.; some supplementary bracing was also used. Propane bottled gas and torches were used for heating; these were supplemented by the heat of hydration of the concrete. Four burners were provided for each pair of buildings, each burner having a capacity of 200,000 btus per hour. With these, it was possible to attain a temperature within the buildings of 120°, but this temperature was not employed for curing.

Dimensions of the buildings were as follows: For the smaller structures, 40 ft. long; 24 ft. wide at the bottom and slightly less at the top; and 7 ft. high. For the larger structure, 40 ft. long; 24 ft. wide at the bottom, tapering to 16 ft. at the top; and 25 ft. high. This height was designed to protect the highest point of the concrete work.

Curing Procedures

In preparation for pouring the footings and the shear keys, two of the buildings were moved into position; by the following day, frost would be thawed to a depth of 18 ins., permitting work. The smaller buildings were used for footings and key construction; the larger buildings for the walls. After pouring, the structures were kept in position for a minimum of 72 hours to permit the concrete to reach a strength of 1500 pounds per sq. in. before being exposed to cold weather. During

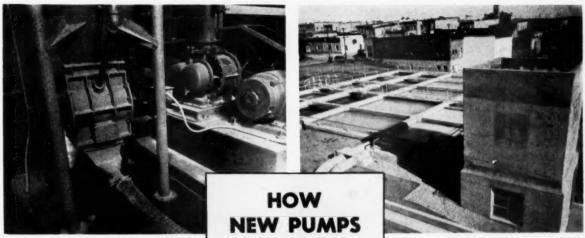
the curing period, temperature was kept at about 70° in the larger buildings.

The bracing action of the Presdwood panels gave the stability necessary to permit moving as the work progressed. It would also be possible to dismantle the structures and move them to another location. In moving the buildings on the job, the tractor was normally used; but when there was no room for it to maneuver, the crane was used.

The first concrete was poured Dec. 7, 1952 and by April 8 the concreting was 76 percent complete. The floor slabs are to be poured during the summer and it is expected that the entire project will be completed by the late summer of 1953. Charles Swain is project engineer on the work.



PORTABLE shelters for cold weather concreting. Smaller structure in fore-ground, behind crane; larger building in rear. Another set is at left rear.



ROOTS blower at the right; chemical feeder left center.

A 19 percent increase in billable gallonage per kwh of power consumed accompanied by a 90 percent increase in net operating profit has been the experience of Beloit. Kansas, since it started operating its new municipal water plant in July, 1950. Pumping costs per gallon dropped 16.3 percent from 1949 to 1951; but pumping cost reductions are only part of the story. The new water treatment plant furnishes better water than did the old plant and at a 6 percent lower chemical cost. This is in spite of an overall increase in the cost of treating chemicals, particularly coagulants.

Beloit has had a municipal power system since 1908; the original water plant was constructed in 1917, immediately adjacent to the power plant. By 1935 it became necessary to increase the capacity to 800,000 gallons per day. Ten years later this supply was insufficient.

The possibility of enlarging the then existing plant was considered to be dim indeed for the floor of the plant was some 2 ft. below the crest of an already experienced flood and some 6 to 8 ft. below the possible flood height of the river. Furthermore, with the banks of the river on one side of the available land and railroad tracks on the other the physical space available was not sufficient for a plant of the capacity that would be needed.

Consequently, it was decided to build a new building above the highest predictable flood level to house both the power plant and the water plant. This building, erected at a cost of \$950,000 was completed in 1950 and the waterworks portion of the utility system

RAY G. VOLLENDORF

CUT

WATER PLANT

POWER COSTS

Superintendent of Utilities

Beloit, Kansas

was switched over to the new plant in June of that year.

One of the most beautiful buildings of its type in the state, it is approximately 194 ft. long by 75 ft. wide. Of steel frame construction, the outside walls are buff face brick while the interior is done in glazed tile. Terrazo floors, aluminum handrails, and marble operating tables not only add to the appearance but reduce maintenance costs by virtue of the fact that they are easy to keep clean.

The water treatment plant removes hardness from the water as well as turbidity. The capacity of 1,500,000 gallons per day can be doubled with only slight modification to the building. Two Fairbanks-Morse Pomona vertical low-head pumps with a capacity of 350 gpm and 700 gpm respectively, pump to the plant from the raw water intake adjacent to the river. The raw water flows through a 12-in. line to a mixing well at the treatment plant where lime, soda ash and alum are added and stirred for five minutes with a Link-Belt vertical flash mixer. Next stop is the coagulation basin where forty minutes of agitation is provided by flocculators. After coagulation, the water flows

 GENERAL view of plant; influent flume in foreground.

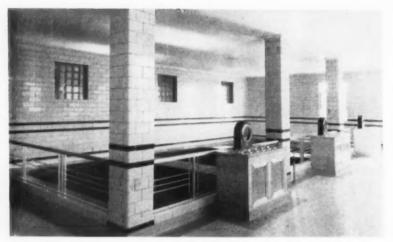
to a series of settling basins with a total sedimentation time of six hours.

After sedimentation, the water passes through the filters. There are three filters, each with a capacity of 500,000 gallons per day at a rate of 2 gallons per sq. ft. per minute. Hydraulic filter valves are provided, operated from within the plant. Filter backwashing is handled by a 10-in. F-M centrifugal pump which puts out 3200 gpm with a discharge head of 40 ft. It is driven by a Fairbanks-Morse 50-hp induction motor.

Chemical Handling Methods

Considerable thought has been given to the handling of chemicals. Lime, soda ash, and aluminum sulphate are shipped in by rail in carload lots. The rail spur is 180 ft. from the treating building and the dry chemicals are pneumatically piped to storage bins directly over the chemical feeders. This system utilizes a Dracco pneumatic convevor powered with a Roots-Connersville blower driven through V-belts by a 30-hp. F-M motor. To facilitate the handling of bagged or packaged chemicals a hydraulic elevator has been provided to lift packages and bags up to the chemical storage room on the second floor.

Dry chemicals are fed through hoppers which discharge to Omega chemical feeders on Fairbanks-Morse scales which automatically weigh each charge. Feed from the scales to the mixing tank is pneumatic, using the same blower that is used for transferring the chemicals from cars to storage.



• FILTERS and control tables are shown in this interior view of the plant.

An underground reservoir with a capacity of 500 000 gallons holds the treated and filtered water until it is pumped up into the elevated tank. Three Fairbanks-Morse centrifugal pumps are used in this service. One 3-in. unit has a capacity of 350 gpm. at 200 ft. TDH; a 4-in. pump has a capacity of 700 gpm. at the same head; and another 4-in. capacity of 950 gpm. at 284 ft. TDH. All three pumps are driven by F-M induction motors. Should the demand for water justify the addition of another pump, provisions have already been made for its installation. These pumps, in common with the 3200-gpm. filter backwash pump, are located in a pump pit which insures a positive suction head at all times.

Chlorination with selective injection points has been provided for with two units each having a capacity of 50 lbs. every 24 hours. The water analysis laboratory where the chlorine content and the hardness are constantly checked, is located near the main plant entrance and is used by the power plant personnel as well as by the men in the water plant.

Designed by Wilson & Co., Engineers, the plant was constructed by the Douglas Construction Co. under an arrangement whereby the city paid a fixed fee for the construction equipment, tools, and supervision of the work. Labor costs were paid directly by the city. Three utility superintendents acted for the city during the two years the job was in construction: V. E. Houghland started the work; it was carried forward by Robert Peart; and was completed by Ray G. Vollendorf.

Due to the increased efficiency

of the new pumps, operating economies became apparent immediately. From 1949, the last full calendar year of operation with the old plant. to 1951, the first full calendar year of operation with the new plant, net revenue after depreciation increased from \$6,736.92 in 1949 to \$12,868.08 in 1951. A total of 94,790,900 billable gallons were pumped in 1949 at a power consumption of 206,760 kwh. Power cost was \$0.0147 per kwh for a total price of \$3,039.37. These figures calculate to a pumping cost of 3.14 cents per thousand gallons. In 1951, 90,261,200 gallons were pumped with a power consumption of 161,-830 kwh, at a rate of \$0.0144 for a total cost of \$2,330.35 or a pumping cost of 2.58 cents per thousand gallons. Corrected to the 1951 power rate, the 1949 cost per thousand gallons would have been 3.08 cents per thousand gallons so that the net saving due to increased pumping efficiency is 16.3 percent.

Chemical treating costs dropped from \$8,398.59 in 1949 to \$7,879.40 in 1951. Correcting for the lower quantity of water pumped in 1951, net savings amounted to slightly more than 6 percent. Accompanying the lower cost of chemicals per gallon of water pumped was a substantial decrease in residual hardness and turbidity.

The great improvement in working conditions represented by the new plant has undoubtedly played its part in the increased operating efficiency. "Color - conditioned" throughout, the plant offers the utmost in operator convenience and the color scheme is arranged to give the maximum of visibility with a minimum amount of eye strain and fatigue.

County Procedures in a Road-Mix Oiling Program

GEORGE D. McCARTHY, County Surveyor, Butte, Montana.

UR 1952 road-mix oiling program resulted in completing 9.26 miles of resurfacing over worn out black top. The cost was \$4,815.82 per mile. The project required 174,-475 gallons of MC3 and SC3; 8,755 cu. vds. of sand, which cost 60 cents to \$1.20 per yd., depending on the length of haul; and 874 cu yds. of gravel, which cost \$2.90 per yd. delivered, with the closest gravel pit 23 miles away. Equipment used included two No. 12 Caterpillar graders, one Galion motor grader, one Rosco bituminous distributor, one Seaman Pulvimixer, a Dodge power wagon, three Ford trucks and a roller. Procedure was as follows:

(1) Scarify the old surface and pulverize with the Seaman and with the motor patrols; add oil, mix, lay down and roll. (2) Haul in new material by night shift, windrow and dry material with patrols and mixer, apply the oil, mix again, lay down and roll. We started our program on July 1, 1952 and completed it on August 18th.

1953 WASHO Flexible Road Test

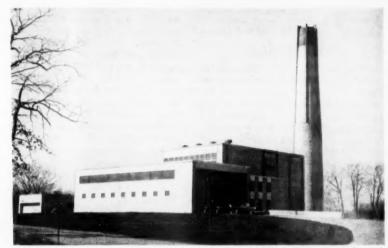
The first stage of the 1953 operations on the WASHO test road located about half-way between Ogden, Utah and Pocatello, Idaho, began in early April and is to continue for about 60 days. The project was constructed last summer and the test sections were subjected to about 17,000 heavy axle loads last fall. Only the two 6-inch sections were seriously injured. During the winter, light traffic has been operated over the loops, and many special studies concerning the temperature and moisture contents in the pavement and subgrades have been conducted.

The first stage of the 1953 tests consists of deflection measurements under single axle loads ranging from 10,000 to 22,400 pounds, and tandem axle loads from 18,000 to 40,000 pounds.

The second stage consisting of regular test traffic of 18,000 and 22,400 pound single axle loads on one test loop and 52,000 and 40,000 pound tandem axle loads on another will start about June 1. Loads will operate about 18 hours per day, 6 days per week through the summer and on into the fall, until such time as the pavement structure is frozen.

12 FACTORS

to consider



Courtesy Nichols Engineering & Research

REFUSE incinerator recently constructed for the City of Brookline, Mass.

IN PLANNING FOR INCINERATION

THE essential factors to be considered when planning for refuse incineration may be listed under twelve headings. These are: (1) Collection, traffic problems, schedules and points of collection: (2) location of incinerator sites and the character of the sites: (3) design of the building and the method of handling deliveries of refuse: (4) character of the refuse: (5) design of the furnace; (6) smoke and fly ash control; (7) ash handling and disposition; (8) materials of construction: (9) cleanliness and operation; (10) controls and records; (11) public relations, ordinances and regulations; and (12) costs and financing.

Problems of Collection

All combustible refuse, garbage and burnable rubbish, including tinned food cans should be collected. Empty bottles, tree trimmings and trunks, and inert debris from building demolitions or road repairs, do not constitute a health menace and should be collected and removed at the owner's expense, and not by the regular collection service. Industrial wastes should be collected and disposed of by the individual concern at its own expense, or on a fee basis, but not at the expense of the taxpayers. Production of such wastes should be charged as a business expense by the industry.

At best, collection trucks generate traffic problems. A refuse collection vehicle is inherently a major offender. Also, the operation of such a vehicle is costly. Wear and tear result from frequent starting and stopping. Production time of the men on the truck is often less than 45 percent of an 8-hour day. Col-

A. E. STILSON.

Alden E. Stilson & Associates,

Consulting Engineers, Columbus, Ohio.

lection vehicle operating costs will generally be in the range of 10 to 15 cents a minute.

In recognition of these factors. the collection department should route trucks off the main thoroughfares; collect in off-hours in congested areas; plan collection routes utilizing right turns to the maximum; avoid overloading trucks by balancing the length of collection routes; provide daily inspection with first and second echelon maintenance as the responsibility of the driver; and assure third and fourth echelon maintenance and weekly inspection by skilled repair shop men. One truck should be kept in reserve for each three required daily. A uniformed inspector should be on duty in the collection district when operations are in progress. Two collections should be provided weekly for wrapped garbage from May to October in residential areas, and one from October to May.

The business district should pref-

erably be serviced between 5 and 9 AM daily except Monday. If at all possible, collection vehicles should be off the streets between 11 AM and 9 PM. The householder should be required to place his contributions at the curb before the scheduled collection time; and he should remove the container within one hour after collection.

Little or nothing is saved by allowing greater time intervals to elapse between scheduled collections. Less frequent collections contribute to odor, litter, rodents, insects and overloaded trucks. Cost records, when kept, indicate that no savings are attained.

Location of Incinerator

A stream bank or lake front is no place for an incinerator. If possible, avoid valleys, even though they are remote. Level and preferably high ground in an industrial district, with proper landscaping, will pay dividends in first cost, operating costs and public relations. The plant must be located with consideration for the city road net and to provide the least possible interference with principal lines of traffic. If it is necessary to operate on a street crowded with morning rush hour traffic, select the plant site so that collection vehicles en route to the incinerator oppose traffic.

A good site will pay off in lowered operating costs and fewer complaints. A small, well-found site can be justified even at a higher initial cost. Disposal of incinerator ash is a

minor factor. Usually one or two trucks can carry the ashes from 10 to 15 trucks of unburned refuse.

Building Details

The design and the materials of construction should combine durability and ease of cleaning; and the structure should be fireproof. Forced ventilation, with a minimum of openings, except for trucks, is good practice. Weighing facilities and suitable office space for keeping records are essential. Choice between the floor dump or the storage bin type of plant depends on the size of the community. Ramps are costly to build and expensive to maintain and may be a truck hazard. In every case, ease and speed of moving the truck into and away from the plant is primary. The greatest portion of the cost of refuse disposal is normally in collection, and prime attention should be paid to facilitating truck movements

In larger plants, storage bins of about two-thirds the 24-hour furnace capacity are normal; provision for frequent cleaning of the bins is essential. Using a bin and crane combination permits easy mixing of dry combustibles with wet materials. Inevitably large quantities of non-combustibles, such as metals, are delivered to a plant. Separate bins to accumulate such materials are essential to good operation and housekeeping. In some cases, shredders for handling tree trunks have been valuable, the chips being delivered to the regular storage bin for charging. Salvage of paper, boxes and other items should be prohibited, as these materials are more valuable for fuel than for sale. Salvage operations take up valuable space, slow up procedures, increase operating costs and contribute to poor housekeeping and to fire haz-

In smaller cities, floor dump plants are fairly satisfactory, provided collection schedules are maintained to mesh with furnace operation. In such cases, each load is emptied directly into the furnace. If the floor is properly swept or washed down after each load is dumped, a floor dump plant is not objectionable. An ash tunnel floor is desirable; without ash hoppers, good housekeeping is difficult.

The small plant, just as much as the large one, should be well land-scaped; roadways, aprons and ramps should be ample. A suitable side hill site may eliminate the need for a ramp.

In the last 30 years the character of refuse has changed radically with the buying habits and marketing methods of the American people. From a mixture of 80 percent or more of garbage and 20 percent or less of rubbish, refuse is today a mixture of 60 percent or more of dry rubbish and 40 percent of garbage; and the garbage is more combustible. There is a trend toward higher heat values per

production. In municipal refuse there is often 50 percent water and ash. The combustible, free of ash and water, is 80 percent volatile and 20 percent fixed carbon. In the incinerator, water must first be driven off. Evaporation is a cooling process and no combustion occurs while the material is drying. Next, the volatile gases which will burn are distilled off and burn in suspension. Before the fixed carbon



Courtesy Morse Boulger Destructor Co.

INCINERATOR for Hempstead, L. I., looks like a modern office building.

pound of ash and moisture-free material fired, due in part to cellophane or plastic wrappings. In the preparation of frozen foods, spoiled and unusable material is eliminated at the factory and such materials do not reach the garbage pail. The home garbage grinder is becoming increasingly popular. Where proper provision is made in sewers and at the treatment plant, garbage grindings are as easily handled as is sewage.

An analysis of the average mixture received today for incineration may approximate that shown in Table 1.

Burning of refuse presents an entirely different problem than the burning of usual fuels for power can be ignited, interference from ashes, glass, tin cans and other inert substances must be overcome. Once this is done, the fixed carbon reacts with oxygen and burns, but air must be supplied.

What has been said suggests the combustible difficulties of designing an incinerator firing chamber. An equally difficult problem is handling the bulk to be received. Wrapped garbage weighs 700 to 1100 pounds per cubic yard. Dry refuse seldom weighs more than 200 to 250 pounds per cu. yd. A ton of mixed refuse will probably weigh 500 pounds per cubic yard as charged into the furnace. That is, a ton occupies four cu. vds. of space. Thus, a furnace to burn 100 tons of refuse in 24 hours requires a firing chamber which will handle from 16 to 20 cu. yds. of material an hour, or 4 to 5 tons. An incinerator firing chamber is concerned more with volume than with weight. In addition, incinerator ash does not move as readily as the ash from a coal-fired boiler. Though mechanical stoking has been provided, which is a boon to labor as well as to operating efficiency, space is still necessary.

In an incinerator, the principal objective is the destruction of the

Table 1—Analysis of Typical Garbage-Refuse Mixture

Water	32 percen
Ash	18 "
Combustible	50 "
Heat value, per pound as fired	4,000 btu
Volatile HC, per cent. of total combustible	80
Fixed carbon, percent of material fired	20
Theoretical air for com-	6 68 lbs

refuse. Heat release should be as low as is compatible with good combustion. Experience has shown that a heat release of 14,000 to 18,000 btu per cubic foot of furnace volume is good practice. Heat damage is reduced and also shock from cold air.

For the average city, there is little opportunity to make and sell steam profitably. Usually the additional cost of building, furnace, boilers and equipment to generate power make the proposition unattractive. If local conditions are such that the proposition is attractive, the incinerator must be designed accordingly.

In a furnace using coal or oil, the air supply can be regulated closely to the theoretical 100 percent requirement. In an incinerator, such regulation is impossible, and 150 percent of theoretical air requirements is more likely. Neither is it possible to calculate closely the time for combustion. Design must be of a broad nature that will allow for these and other similar factors.

The chimney should be designed with height to produce adequate negative pressure and with an inside cross-sectional diameter sufficient to carry off all the products of combustion. A velocity of 18 to 20 feet per second is desirable for the chimney, with lower velocities in the furnace.

Incorporation of good combustion principles in the furnace will greatly reduce the smoke problem. Mechanical devices, such as fly ash accumulators or precipitators, may be used to improve the removal of non-combustible particles—the so-called fly ash—in the flue gases, but good furnace design is the first line of defense. Keeping the flues and the velocity in them low greatly reduces the emission of fly ash.

Ash Disposal

In the plant, ashes should be handled in an ash tunnel or in a separate enclosure to prevent dust nuisance in the remainder of the building. Ashes should be quenched. Except in very small plants, ashes should not be handled on the furnace floor, nor should they be left in contact with structural members of the furnace or building, for they are very corrosive.

The ash dump should be carefully controlled. Bulldozers are most useful for leveling the surface of the dump. Vehicles passing to and from the dump should be routed over the filled portion as much as possible to provide compaction. Unburned ma-

terials should not be allowed on the dump. Large pieces of metal should be placed at the toe of the slope and filled over with ashes.

It is not good practice to locate a dump at the shore of a river or near a lake, because of the pollution conditions that will be created. Ashes, however, make a good fill for swampy areas and the cans, wire and other materials in the ashes tend to form a mat which will sustain quite heavy loads.

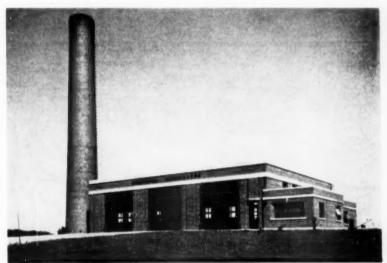
Materials of Construction

Building brick, reinforced concrete and structural steel properly fireproofed below the charging floor make very satisfactory building materials. Concrete and einder block may be used to a limited extent, in areas where there will not be grease or other materials which will stain them. In offices and dressing rooms, a tile dado four or five feet high is desirable. Door openings and areas where trucks move should be protected with very substantial steel or cast iron elements. Dumping bins and loading platforms should incorporate oak dumping logs to prevent breakage from trucks. Door openings for trucks should be of the rolling steel type. Mechanical, prefProper expansion joints must be installed to allow for free expansion and contraction of the furnace. Heavy loads should not be placed on refractories exposed to heat. Plastic refractories are not recommended.

In flues and chimneys, refractory brickwork of second quality fire brick give excellent performance. In the furnace, the refractories should be of a balanced aluminum silica mixture, low in iron with R/O radical as low as is possible. The No. 1 refractories in a furnace may have a fusion point equivalent to cone 31.32. In areas where temperatures are under 2000°F a fusion point equal to cone 27-28 is sufficient.

Other Factors

It pays dividends to provide clean uniforms regularly to every man employed at the incinerator for it is an important element in getting good operation. The effect on the morale and the attitude of the men is reflected by a clean plant. Good drainage throughout the plant, and adequate means for washing down the plant and the trucks are essential. Hot water in ample quantities is the easiest thing to provide at an incinerator. The first cost of



Courtesy Pittsburgh-DesMoines Steel Co.

ATTRACTIVE and medern incinerator for the City of Green Bay, Wisconsin.

erably motor-operated, doors are desirable. The hood enclosures for the doors, when in open position, should be protected against the

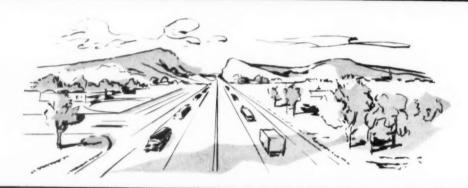
Furnace foundations should, in all instances, be separate from building foundations; and the building structure and floors should not be connected in any way to the furnace.

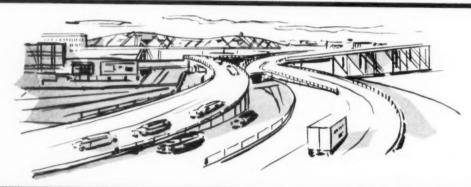
low pressure hot water equipment is minor and maintenance is negligible.

Truck scales are necessary to good plant operation. Records of material coming in and of ashes removed, together with a record of the arrival and departure times of trucks aids in operational supervision.

(Continued on page 134)

What YOU should KNOW ABOUT







SOIL ENGINEERING

by LEO J. RITTER

This is the first installment of Prof. Ritter's article. The second and third will appear in September and October. In this series all phases of soil engineering will be treated in simple, easily understandable language. Parts II and III will conclude the discussion of basic soil properties and their meaning; laboratory tests; soil classification systems; and practical applications in field identification, soil surveys and construction principles.

FROM an engineering viewpoint, the term "soil" has very broad meaning. Soil may be considered as being all the earth material which covers the rocks of the earth's crust. Another description is "any unconsolidated material which can be excavated and handled with a pick and shovel". Soil, under these definitions, include a wide variety of materials ranging from small boulders through gravel and sand to highly plastic clays.

Soil engineering, a relatively new term, may be defined as the application of rational thought to soil problems associated in any way with civil engineering. Soil engineering deals with practical problems, providing the basic tools needed for application, while soil mechanics is more theoretical in nature.

Problems encountered in soil engineering may be grouped into two broad classes. The first of these includes those associated with the soil in its natural condition, as when a natural soil deposit serves as a foundation for a highway fill or when we are concerned with the behavior of soils encountered in a highway cut. This is the type of problem which is of greatest importance to structural and foundation engineers, since foundations of structures generally depend upon natural soil deposits for support. The second broad phase of soil engineering deals with the use of soils as construction materials, as when they are used to form an earth fill, compacted to form the subgrade for a pavement or an airport runway. or employed to construct a gravel surface for a road.

The principles of soil engineering are important to all who deal with the earth for engineering purposes. Considerations relative to soils enter into many phases of the planning, location, design and construction of the vast majority of engineering structures.

There are many examples of the necessity for knowledge of soils on the part of engineers who deal with street, highway and airport problems. For example, the existence of unsatisfactory or difficult soils may be a primary factor in finding a better location for a highway or an airport. Such a structure is basically no better than the soil upon which it rests. Soil engineering makes us aware of problems which may be encountered in dealing with a particular soil when it must serve as a foundation for a structure of

this type and teaches us how to get the most for our money.

A knowledge of soils makes it possible for us to determine if the soil excavated in a cut section may be successfully used to make a fill and how it must be handled during construction. Similarly, it will let us anticipate drainage problems and will tell us how they may be dealt with. For example, proper interpretation of the results of a soil survey may indicate the likelihood of seepage of water through the slopes of a highway cut; with such knowledge, plans may be made during design to control this flow of water. Adequate understanding of soils and their behavior may go a long way toward the universal problem of providing adequate, all-weather roads and streets which carry light to moderate amounts of traffic by the efficient use of locally available materials for soil stabilization. Thus soil engineering provides an approach to the satisfactory solution to many ordinary, everyday, practical problems of civil engineering.

Conversely, lack of adequate knowledge of soils may lead to serious failures. Many miles of roads and streets have failed to fulfill their intended function satisfactorily because there was lack of knowledge of subgrade soil conditions by the men who built them. All of us are familiar with highway surfaces on fills which have become wayy, or cracked or broken because someone failed to realize that some soils will compress greatly under the weight of an embankment. Similarly, much of the frost damage that occurs in northern states could be prevented by application of the principles of soil engineering.

Variable Nature of Soils

Because of the random nature of the processes of forming natural soil deposits, soils vary widely from place to place in their physical and chemical composition. Although, generally speaking, soils derived from the same parent material under similar factors of geographical location, climate and topography will be similar wherever they are found, several soil types can, and usually do, exist within a comparatively small area. Soil deposits also vary with depth. Further, the properties of any given soil depend not only upon its general type but on its condition, that is, the amount of water it contains, its density, etc. It must therefore be realized that soil engineering is not an exact science; some approximations are both



Courtesy Bureau of Public Roads

CUT IN volcanic loess soil, Inter-American Highway in Gautemala.

necessary and permissible because of the variable nature of the material with which we are dealing.

Many names are used to describe soils and an understanding of the meaning of these terms is necessary to the understanding of this and other literature on the subject.

The four most commonly used terms in our dictionary of soil names are gravel, sand, silt and clay. These will first be defined in terms of grain size, that is, the average dimension (diameter in a general sense) of a soil particle contained in a soil mass.

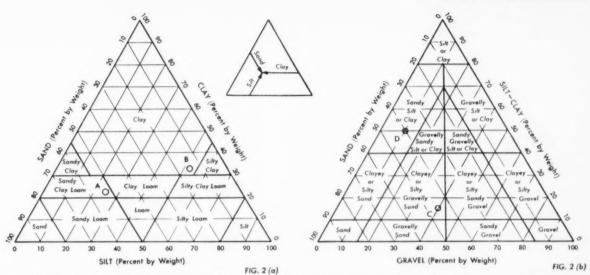
A number of different scales have been used to define the grain size limits applicable to each of these major soil types. A scale which is in wide use among highway engineers, Fig. 1, covers a range of particle sizes from 3 inches to the extremely small clay sizes, some of which are colloidal with particles so small they cannot be distinguished by an optical microscope.

There are two general methods for determining grain sizes and the relative amounts of material of different sizes which are contained in a given soil—sieve analyses, where the soil is passed through a series of successively finer sieves (screens with square openings) and thus divided into fractions of known size; and methods employing sedimentation.

Obviously many soils will contain particles which fall into two or more of the major groups shown in Fig. 1. Two methods of systematizing the application of descriptive terms to soils containing particles of different sizes are illustrated in the "textural classification charts" of Fig. 2.

The chart of Fig. 2 (a) is widely used by highway engineers and is applicable to soils which do not contain gravel. To illustrate the use of the chart, which is based upon the size limits of Fig. 1, suppose that an oven-dry sample of soil is composed of 53 grams of material which falls into the range of sand sizes, 25 grams of silt and 22 grams of clay. The total weight of the sample is 53 + 25 + 22 = 100 grams. Hence, the soil contains 53% sand, 25% silt and 22% clay. This soil would plot at point "A" on the chart and

SOIL ENGINEERING



TRIANGULAR soil classification charts are widely used. Left, Bureau of Soils system; right, Corps of Engineers system.

thus would be described as a "sandy clay loam." Similarly, a soil which contained 15% sand, 53% silt and 32% clay would plot at point "B" and would be called a "silty clay."

The chart of Fig. 2 (b) is based upon the following size limits: Gravel—3 ins. to US No. 4 sieve; Sand—No. 4 sieve to US Standard No. 200 sieve; and Fines—finer than No. 200 sieve. The size of opening for US No. 4 sieve is 4.76 mm square; and for US No. 200 Sieve it is 0.074 mm square.

The fines or "fine fraction" may be either silt or clay. The decision as to whether the fine fraction is silt or clay is based primarily upon other characteristics of this material, as explained later. A soil which contains 40% gravel, 45% sand and 15% fines would plot at point "C" on the chart and would be called a "silty, gravelly sand" or a "clayey, gravelly sand", depending on the characteristics of the material passing a No. 200 sieve. Similarly, a material containing 10% gravel, 40% sand and 50% fines would plot at point "D" and would be either a "sandy silt" or a "sandy clay."

Although information relative to grain size is important, such knowledge alone will not be enough to give an accurate picture of the properties of a soil and its behavior under various conditions. For example, two sands composed of particles of about the same size may be radically different in such a property as stability under wheel loads if one is a beach sand composed of smooth, rounded grains and the other has grains which are sharp and angular. Thus additional information must be obtained if the description is to prove adequate.

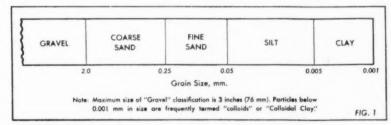
Comprehensive descriptions of the four major soil groups follow:

Gravel and sand are coarse-grained soils, readily detected by visual inspection. They are distinguished, in general, by their relatively high stability under wheel loads when confined, as in a subgrade beneath a pavement; the ease with which water will flow through them; and their failure to shrink or expand in detrimental amounts with change in moisture content. The term gravel is usually applied to natural pit, river or bank gravels consist-

ing largely of rounded particles; crushed gravel or crushed stone is the term applied to the products of crushing larger rocks into gravel sizes.

Silts are fine-grained soils of low to medium plasticity [the meaning of the term "plasticity" will be explained in more detail later, but in general it means that the soil possesses the ability to be molded into various shapes without cracking, breaking or crumbling]. They are somewhat intermediate, both as to size and characteristics, between sands and clays. They generally undergo considerable shrinkage or expansion with change in moisture content and possess variable stability under wheel loads. If they contain large amounts of scale-like particles such as mica flakes, they are likely to be quite compressible and somewhat elastic. Organic silts contain considerable amounts of decomposed organic matter and are generally highly compressible and

Clays are composed of very fine grains. They are generally plastic through a wide range of moisture content, have considerable strength when dry, undergo extreme changes in volume with change in moisture content and are practically impervious to the flow of water. Lean clay is the term given to silty clays or clayey silts; while fine, colloidal clays of high plasticity are called fat clays. Clays may have considerable strength in their natural condition but this strength may be sharply reduced and sometimes completely destroyed if their natural



DEFINITIONS of major soil types in terms of grain size.

structure is disturbed, that is, if they are remolded.

Many other names are used to describe soils. Some of these are widely used while others are of local significance. Our dictionary is limited to those of general significance.

Other Terms

Inorganic soils are those which contain little or no organic matter; not enough to influence engineering properties. Most soils are inorganic,

Organic soils are those which contain large amounts of decomposed or partially decomposed organic matter. Highly organic soils, without exception, present difficult construction and foundation problems. They are distinguished by their dark brown to black color and distinctive odor.

Residual soils are those which lie directly above the parent material from which they were derived. Such deposits are characteristically erratic and variable in nature.

Transported soils are those which have been carried to their present position by the action of such forces as gravity, wind, water and glaciers. Included in this group are all the major soil types and by far the largest proportion of soils with which the engineer must contend. Sedimentary soils are those deposited in water during the process of their formation: included in this category are the gravel and sand deposits found along the upper reaches of rivers in arid and semiarid regions, the highly organic silts encountered in river deltas in humid regions, and highly flocculent clays of marine origin found in regions which were submerged beneath the sea in earlier geological periods.

Boulders are detached masses of rock ranging in size from 3 inches up to the maximum size that can be excavated by hand. In some localities the term is applied to much larger detached rock masses.

Clay minerals are highly complex chemical compounds (hydrous aluminum silicates) contained in natural soils, particularly clays. They are important in that the presence of even small amounts may determine significant soil properties.

Fill is any man-made deposit of soil, ranging from carefully constructed highway fills and earth dams to the typical accumulation of debris found in a city dump.

Courtesy International Harvester Co.

 MOVING soil with bulldozer on highway re-location project. Loam is an agricultural term used to describe a soil which usually contains a range of sizes from coarse to fine, is easily worked, and is productive of plant life. It is a term which has little significance in engineering, except as related to existing textural classification systems.

Loess is a fine-grained wind deposited silt which is characterized by its nearly uniform grain size, low density and pronounced planes of vertical cleavage.

Muck (or mud) is extremely soft silt, frequently highly organic, and usually found in swampy areas and river or lake bottoms.

Peat is principally partially decomposed vegetable matter. Its very high moisture content, the presence of fibrous organic matter, and extreme compressibility makes it a highly undesirable foundation material.

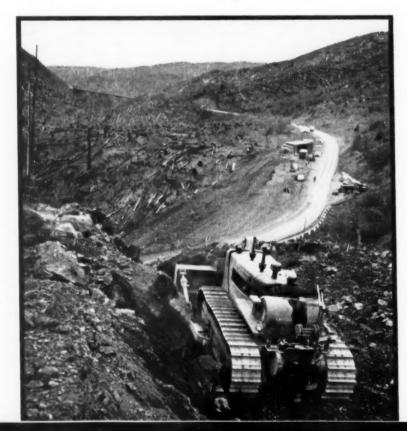
Quicksand really defines a condition rather than a type of soil. A "quick" condition may occur in a gravel, sand or silt because of an upward flow of water which "lifts" the particles and decreases the ability of the soil to support loads.

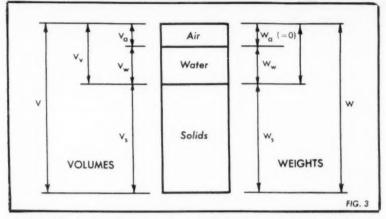
Topsoil is another agricultural term applied to surface soils which are productive of plant life; it has little engineering significance except for surface dressing procedures.

Inorganic soils may be regarded as being made up of three principal constituents-air, water, and the soil particles themselves (solids). They may thus be said to have three-phase composition. Organic soils may be somewhat more complex and more difficult of analysis. although they have the same basic composition. The arrangements of the three principal constituents of a natural soil may be quite simple in the case of a natural sand where the bulky sand grains are in contact with one another (single-grain structure) and the spaces in between the soil particles (the voids) are filled with air or water, or a combination of the two. Both the arrangement of the soil grains (structure) and the interrelationship between solids, water and air may be much more complex in the fine-grained soils, particularly in clays.

The Composition of Soils

Reference is made to Fig. 3. In this simplified sketch the total volume is that occupied by an actual soil mass; the volume shown for each of the principal constituents is the same as that occupied by that material in the actual mass; and so are the weights. Fig. 3 does not attempt to show the arrangement of the three principal constituents in the actual mass, but only their weights and volumes.





• SKETCH showing factors used in calculating volume-weight relationships.

The following fundamental relationships and definitions are impor-

Volume Relations - In volume relationship formulas, "V" designates the volume: it may be modified by a subscript letter to indicate what particular volume factor is referred to. For instance V_v refers to the volume of voids; V, to the volume of solids; and Vw to the volume of water. The void ratio is the ratio between the volume of voids and the actual volume of solids. The void ratio is designated by the letter "e" and is always expressed as a decimal. The formula is $e = V_v/V_*$. As an example, if V, is 0.35, that is, if 35% of the mass is voids, then V. is 0.65 and the void ratio e is $0.35 \div 0.65 = 54\%$. The void ratio may be, but seldom is, greater than 1.

Porosity is the ratio between the volume of voids and the total volume of the mass. It is always expressed as a percentage and is designated by the letter "n". The formula is $n=100 \times V_{\rm e}/V$. For instance, if the voids are 35% of the mass, the porosity is 35%.

Degree of saturation expresses the relationship between the volume of water in a soil and the voids in the soil. It is designated by the letter "S" and is always stated as a percentage. When S = 100, meaning that the voids are completely filled with water, the soil is said to be saturated.

Volume-Weight Relationships — "W" is always used to designate weight factors, and is modified by subscript letters to indicate the weight referred to. W, is weight of solids; W_w is the weight of the contained water; W_a is the weight of the contained air, but air is assumed to have negligible weight so W_a is 0.

The moisture content of a soil is designated by "w", which equals $100 \times W_w/W_s$, and is expressed as a percentage.

If a soil mass is dried to standard weight in an oven maintained at a temperature between 100° and 110° C, then w = 0%, and the soil is said to be "oven dry." If a soil mass is air dry, as it might be if it were allowed to remain in an open pan for several days, some moisture remains it it, which is termed "hygroscopic moisture."

Unit Weight — The ratio between the weight of a soil mass and the corresponding volume is indicated by the Greek letter γ , which equals W/V. In the highway field the term "wet unit weight" is applied if the moisture content is greater than zero; if w=0% (oven-dry) then the term "dry unit weight" is used. The unit weight of water (γ_*) is taken to be 62.5 pounds per cubic foot

Specific Gravity, G., is not illustrated by Fig. 3 but is an important quality which is needed in the numerical examples which follow. G, is the specific gravity of the soil particles or "solids"; it is defined as the ratio between the unit weight of solids (%) and the unit weight of water at some known temperature (usually 4° C.). It is, of course, a dimensionless quantity. Typical values for soils range from 2.66 to 2.80, although higher or lower values may be obtained if the soil has been formed from either unusually heavy or light minerals.

The following examples may serve to show the relationships which exist among the various quantities defined above and their calculation.

(1) Assume that a soil has a wet unit weight of 122.5 pounds per cubic foot and a moisture content of 15.0%. The specific gravity of the soil particles is 2.65. Calculate the dry unit weight W; void ratio e; porosity n; and degree of saturation S.

Referring to Fig. 3, the following quantities are known: $\gamma = W/V = 122.5$ pounds per cubic foot; w = 15.0%, and $G_s = 2.65$.

In making these calculations, we will do it on the basis of 1 cu. ft. of soil, and we will refer to Figure 3, from which it will be noted that W, the total weight, may be expressed:

$$w = 100 \frac{W_*}{W_*}$$

or
$$\mathbf{W}_{w} = \frac{\mathbf{W}_{x} \times \mathbf{w}}{100}$$

we may substitute in Equation (1) to get

$$W = W_x + \frac{W_x \times w}{100}$$

then $100 \text{ W} = 100 \text{ W}_s + (\text{W}_s \times \text{w})$

$$or~W_s = \frac{100W}{100+w}$$

Dividing both sides of the equation by V, we obtain:

$$\frac{W_s}{V} = \left(\frac{100}{100 + w}\right) \frac{W}{V}$$

The dry unit weight of a soil is $W_*/V = \gamma_* = 0$ and the wet unit weight is $W/V = \gamma$. Substituting the values assumed for this example, we obtain the following for the dry unit weight:

$$7* = ** = \frac{W_s}{V} = \frac{100}{100 + 15} (122.5)$$

= 106.5 lbs.

The volume of the solids in our cubic foot of soil is the dry unit weight divided by the specific gravity of the solids. Therefore:

$$V_* = \frac{106.5}{2.65 \times 62.5} = 0.643 \text{ cu. ft.}$$

and the voids are

$$V_{\rm c} = 1.000 - 0.643 = 0.357$$
 eu. ft.

The void ratio

$$e = \frac{V_*}{V_*} = \frac{0.357}{0.643} = 0.55$$

The porosity n is $100 \times V_{\rm v}/V$ or 35.7%. The degree of saturation is $S=100 \times V_{\rm w}/V_{\rm v}$. In this case, we

must first find the weight of water in the voids. This is the difference between the total weight of 122.5 pounds and the dry weight of 106.5 pounds, or 16 pounds. In terms of volume, the water occupies $62.5 \div 16 = 0.256$ cu. ft., which is V_w . Then $S = 100 \times V_w/V_v = 0.256 \div 0.357 = 71.7\%$.

Thus, all the desired quantities have been solved for. In general, the approach illustrated which is based upon the fundamental relationships, is the best and most usable, although various equations or "formulas" have been derived giving the relationships between the

fundamental quantities.

The relationships are simply definitions. Their practical usefulness is in providing a convenient way to express certain volume and weight relationships. Thus, when a laboratory test is performed in order to evaluate shearing resistance the condition of the soil prior to the test may be described by stating its void ratio and moisture content; the way in which these quantities change during the time the test is being performed may be important in its interpretation. The way in which one or more of these quantities varies with other factors may also be important; for example, Fig. 4 indicates the manner in which the void ratio of a typical clay soil subjected to consolidation varies with pressure. Fig. 5 shows the typical relationship which exists between the dry unit weight and the moisture content of a soil subjected to rolling in the field. Specific gravity may be useful in the identification of a soil, since it is generally indicative of the material from which the soil was derived. Of the quantities which have been described, the porosity and degree of saturation are less frequently used than the others.

Other Fundamental Considerations

In addition to grain size, another basic consideration of some importance is grain shape; that is, the general shape of the soil particles. Two basic shapes occur frequently. Bulky grains are those in which the length, width and height are about the same, as in a sand or a gravel. Bulky grains may range from the sharp, rough angular particles produced by crushing rock to the smooth well - rounded particles which are often found in coarse beach sands and gravels. In between these two extremes the terms subangular, subrounded and rounded are applied. Flaky or scale-like grains are those which have the general shape of a sheet of paper; they are thin in comparison with their length and width. Mica flakes offer a familiar example of this grain shape, but the extremely small particles of the clay minerals usually have this shape, also.

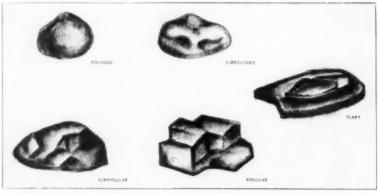
It is obvious that soils composed largely of bulky grains would not behave the same way as those made up of flaky grains. Bulky grain soils are generally stable under static loads, although some of them are displaced easily by vibrations, especially if they are in a loose condition. Soils composed of flaky grains are in general much more compressible under static loads than bulky grain soils, but are less susceptible to vibrations.

Closely related to grain shape and to other basic factors is soil structure, that is, the arrangement of the soil particles with relation to one another. The coarser soils made up of bulky grains usually possess what is called "single-grain structure" in which each particle is in contact with the surrounding ones. Loose, single-grained structures are inherently unstable, being particularly susceptible to shock or vibra-

are usually more compressible and show sharp changes in properties when their natural structure is disturbed and they are remolded. This is the reason why the determination of engineering properties such as shearing strength and compressibility must be based upon the results of tests upon undisturbed samples of these soils. From a practical viewpoint, information relative to soil structure is frequently only of general value. However, there are cases in which soil structure is more important than grain size or chemical composition.

As has been indicated, water is a very important constituent of soils. Water may be present in a soil mass in several different forms. For example, the voids of a soil located below the water table may be completely filled with so-called "free" water. Such water is in its normal form and is subject to the ordinary laws which govern fluid flow. Water may also fill or partially fill the voids of a soil located above the water table because of the effects of surface tension.

An important form of water in soils is adsorbed water. This may be present in the form of thin films



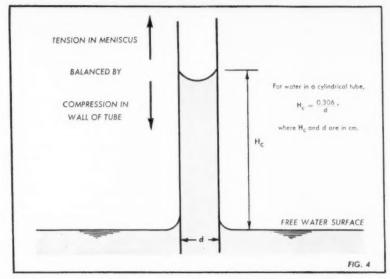
VARIOUS SHAPES of soil particles influence their engineering uses.

tion. Dense, single-grained structures are basically stable. Coarse soils which have this structure in their natural state may, generally speaking, be disturbed or rearranged by digging and handling and re-created in the laboratory with essentially the same properties as the natural soil.

Fine grained soils sometimes have very intricate structures—including those that are called honeycomb, flocculent and complex. A soil which has one of these structures generally has a higher void ratio than one with a single-grain structure. Void ratios are particularly high in soils of flocculent structure, and these

surrounding the separate soil particles. Assume that a soil is in an air-dry condition; that is, to all intents and purposes it is dry. If this soil is then heated in an oven it will lose weight; the loss will be relatively slight for a coarse-grained soil like a sand, and much greater for a fine-grained soil, like a clay. The weight loss is due to the loss of adsorbed water.

The films of adsorbed water which surround the soil particles are very thin. In coarse soils the film is so thin in comparison with the diameter of the particle that it has very little effect upon the behavior of the soil. In fine-grained



• CAPILLARY rise of water in small tube due to surface tension.

soils, particularly the clays, the thickness of the films may be relatively great in comparison with the diameter of the particles, which are themselves extremely small.

Adsorbed water in clay soils permits the clay to deform plastically -that is, without crumbling or breaking when mixed with varying amounts of water. The water in the adsorbed films has properties which are quite different from ordinary water. Next to the soil particle the film may act as a solid which can be removed only by heating to high temperatures; the outer surface of the film may behave as a viscous liquid. The plastic behavior of clays may be conveniently visualized as being due to the sliding of the soil grains across one another on the viscous adsorbed water films. Soils which are plastic over a large range of moisture content are frequently called cohesive soils; clays fall in this group. Soils which are not plastic are called cohesionless soils; gravels and sands are in this group. Silts are usually classed as cohesionless soils, although some of them are slightly or moderately plastie.

Capillarity

In general terms, by capillarity is meant that property of a soil which permits water to be drawn into it from a free water surface as a lamp wick draws oil from the reservior beneath. The capillary movement of water in soils is generally associated with upward flow of water from the water table, although in reality capillary flow can occur in any direction. One of

the most common manifestations of capillarity in soils is the fact that soils are frequently found to be saturated, or partially saturated, though they are some considerable distance above the water table. We are all familiar with the capillary rise of water in small tubes. This phenomena is due to surface tension and is illustrated in Fig. 4. The water that rises upward in a capillary tube is in tension, hanging on the curved boundary between air and water (meniscus) as if it were a suspending cable. Also, the tensile force in the meniscus is balanced by a compressive force on the walls of the tube.

Other conditions being the same. the height of capillary rise of water in a small tube is inversely proportional to the diameter of the tube: that is, the smaller the tube the greater the height of capillary rise. With relation to capillarity a soil mass may be regarded as being made up of a bundle of small tubes the interconnected void spaces; these spaces form extremely irregular, tortuous paths for the capillary flow of water. The height of capillary rise depends upon the size of the individual voids. Going a step further, it is logical that the individual void spaces are small when the soil particles are small. Hence, the height of capillary rise can be expected to be greatest in the finegrained soils.

This reasoning agrees well with practical experience. From the standpoint of susceptibility to capillary action and the detrimental effects which sometimes accompany the capillary flow of water in soils.

the most critical condition is believed to occur in a fine silt. The eventual height of capillary rise is greater in clay soils than in silts but the upward flow of water in clay is much slower. Thus, the time required for a clay soil to become saturated (or attain a high degree of saturation, since some air may be entrapped in the voids) may be very long. The eventual height of capillary rise in a fine grained soil may be as much as 50 feet vertically in extreme cases, and frequently is of the order of nine or ten feet. Coarse sands and gravel are normally not susceptible to capillary action because of the comparatively large size of the individual void spaces; the height of capillary rise may vary from zero to a maximum of a few inches in these soils.

Soils which are susceptible to capillary action cause many difficulties when they occur as subgrades beneath highway pavements. The water brought up into the subgrade by capillary action frequently can not escape because of the sealing effect of the pavement; the water may then reduce the supporting power of the subgrade soil or cause its expansion. Failure of the subgrade and the pavement may result. Soils which are susceptible to capillarity are also frequently susceptible to frost action, which will be discussed later. When a soil of this type must be utilized as a subgrade the effects of capillary action may be prevented by the use of an "insulation course" of granular material—sand, gravel, or crushed rock—placed between the subgrade soil and the pavement. In areas which are subject to severe frost action the granular layer may have to be of considerable thick-

Shrinkage And Expansion

Closely related to the capillary phenomena just described are the qualities of shrinkage and expansion. Many soils undergo a very considerable reduction in volume when their moisture content is reduced; the effect is most pronounced when the moisture content is reduced from that corresponding to complete saturation to a very dry condition. This reduction in volume is called "shrinkage" and is greatest in clays and other fine-grained soils. Some of these soils show reduction in volume of 50% or more while passing from a saturated to an oven-dry condition. Confined fine-grained soils may also show considerable expansion or "swelling" if they have been dried and

water is then made available to them so that their moisture content is increased. Sands and gravels generally show very little or no change in volume with change in moisture content.

The shrinkage of a clay mass may be attributed to the surface tension existing in the water films created during the drying process. When the soil is saturated a free water surface exists on the outside of the soil mass and the effects of surface tension are not important. As the soil dries out because of evaporation or heating, innumerable meniscuses are created in the voids of the soil; tensile forces are created in each of these curved boundaries between water and air. As indicated in the discussion of capillarity, the tensile forces which then exist in the water films are accompanied by compressive forces which, in a soil mass, act upon the soil structurethe skeleton-like arrangement of soil grains. In the case of the typical fairly dense arrangement of a sand or gravel mass the compressive forces are of little consequence and very little or no shrinkage results. In fine-grained soils the soil particles are forced together; hence the mass shrinks. As drying continues, these internal forces become greater and greater until the soil mass attains a certain limiting volume, or else cracking occurs. In some cases the internal forces set up by drying become very large: the existence of these forces accounts principally for the rock-like strength of a dried clay mass. From a practical standpoint, again, it is obvious that a soil which is subject to much shrinkage would present many difficulties in highway and airport construction.

If water is again made available to a soil mass which has undergone shrinkage, it will enter the pores of the soil mass from the outside and reduce or destroy the internal forces previously described. Thus, a clay soil which is confined to some extent will expand or "swell" upon the addition of water. The expansive forces created as the water enters the soil may be very large. If the soil mass is unconfined it will generally disintegrate or "slake" this phenomenon may be observed by putting a chunk of dry clay into a container of water. The mass will fall completely apart, usually in a matter of minutes.

Effects which have been described for clay soils will also generally occur in silty soils although to a lesser degree. Difficulties associated with shrinkage and expansion may be eliminated by the use of sandy and gravelly soils, where this is possible.

Permeability

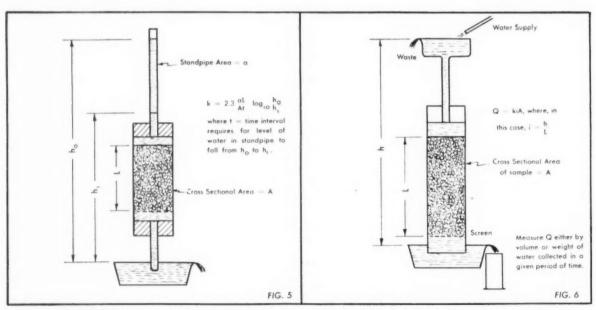
Permeability is that property of a soil which permits water to flow through it. Thus free water may move through the irregular, tortuous passages formed by the interconnected void spaces of a soil mass in much the same fashion as it flows through other conduits, but more slowly. Relatively coarse soils, like sand and gravel, offer comparatively little resistance to the flow of water and are said to be "permeable" or "pervious" soils. Fine-grained soils, particularly clays, offer great resistance to the movement of water through them and are said to be "relatively impervious" soils; in extreme cases clays may be practically "impermeable" or "impervious".

In the large majority of cases the flow of water in soils is "laminar" flow. By laminar flow is meant a type of flow in which the particles of water move along smooth, orderly paths in the direction of flow and losses of energy or "head" are directly proportional to the velocity. "Turbulent" flow, which is marked by irregular, helter-skelter movement of the water particles and by much higher losses of head, may occur in coarse gravels.

For cases involving laminar flow with a hydraulic gradient less than one—in other words, the usual case—extensive use is made of Darcy's equation, which has been found to be applicable to the flow of water in soils both by experiment and experience. Darcy's equation is of the form

Q=ki A, where the symbols have the meaning illustrated in Fig. 6 and in the following discussion

Q = quantity of flow. The quantity is expressed in units of volume of water flowing through a given soil mass in a unit of time. Thus, in the



FALLING head permeameter apparatus on left and constant head permeameter apparatus on right.

English system Q may have the units of cubic feet per second, gallons per minute, or others of convenience.

A = the gross cross-sectional area through which the flow is occuring. Units consistent with those derived for Q must be used; hence, in the English system the area is commonly expressed in square feet.

i = the hydraulic gradient. As indicated in Fig. 6 the hydraulic gradient may be expressed as h/L where h is the "head loss" which occurs in length L. In reality, h represents the amount of energy which is used up in the flow of water through the soil mass; in the English system this loss of energy is h in foot-pounds per pound of fluid. Thus, "i" is a ratio, with h and L both expressed in feet.

k = the coefficient of permeability of a soil. This is primarily dependent upon the void ratio, grain size, structure and the density and viscosity of the fluid involved. The relationship among these variables for typical soils is quite complex and precludes the development of formulas for the coefficient of permeability except for the very simplest cases; some approximate formulas do exist for clean sands. For the usual soil, k is determined experimentally. In the laboratory, two principal types of equipment are utilized. One type is the socalled "constant - head" permeameter which is illustrated in Fig. 6 -the equipment is simple and widely used for determining the permeability of coarse soils. Equipment for the test is assembled so that A and L have known values;



Courtesy Highway Research Board

SUB-GRADE SOIL forced out by pumping action of rigid pavement under traffic.

h is held constant and the quantity of flow is measured directly. Direct substitution in Darcy's equation may then be employed to determine k. A "falling-head" permeameter is frequently used for the testing of fine-grained soils. General arrangement and use of this equipment is illustrated in Fig. 5. In evaluating fine-grained soils the test must be run upon relatively undisturbed samples in which the natural void ratio and structure are preserved. The coefficient of permeability is occasionally determined by largescale pumping tests conducted in the field; such tests are expensive and are generally justified only for important work where laboratory testing will not supply the desired information. For fine-grained soils, k may be determined indirectly from the results of the consolidation test described later in this text.

Values of the coefficient of permeability for natural soils show considerable variation. Typical values are shown in Table I, which has been adapted from the work of Terzaghi and Peck.

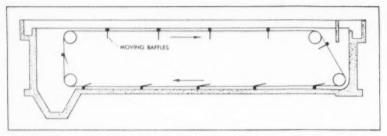
Practical applications of knowledge relative to permeability are numerous. In a general way, sands and gravels will be easy to drain because of their high permeabilities; gravity systems, such as side ditches and pipe subdrains are generally successful in draining such soils. Similarly, silt soils are more difficult to drain by gravity alone and drainage systems to control the flow of surface and subsurface water will be more expensive. Clays have extremely low permeabilities and it is frequently practically impossible to accomplish their drainage by gravity alone.

More specific information relative to permeability may influence both design and construction measures relating to highways and airports. For example, much experience and research has gone into the specifications for materials to be used in backfilling around pipe subdrains. The backfill material must be coarse enough to permit the easy passage of water and fine enough to prevent the intrusion of fine soils into the pipe if the drain is to function properly. Material recommended for use in such work has the approximate gradation of concrete sand.

TABLE I—DATA RELATIVE TO PERMEABILITY (After Terzaghi and Peck)

General Soil Type	Drainage Characteristics	Coefficient of Permeability, I cm/sec*	Laboratory Determination of k
Clean Gravel	Good	100-1.0	Constant-head permeameter
Clean Sand or Sand-Gravel Mixtures	Good	1.0-0.001	Constant or falling-head permeameter
Very Fine Sands, Silts, Mixtures of Sand, Silr and Clay, etc.	Poor to practically impervious	0.001- 0.0000001	Falling-head permeameter; difficult and unreliable
Homogeneous Clays Below Zone of Weathering	Practically impervious	Below 0.000001	Falling-head permeameter; requires experience

^{*}Multiply by 2 to obtain approximate values in feet per minute



 SKETCH showing how moving baffles with hinges might be installed in a rectangular settling tank. Depth of tank is exaggerated in drawing.

As to the depth of our tank, all we shall need is sufficient working space to prevent interferences due to change from forward to backward movements in the water.

Should it be found that the fixed baffle extensions on the wooden cross flights or scrapers cause serious disturbance or counter movement of bottom water to set up rotation, then hinged extensions of metal should be considered for the purpose of hanging down to form

MOVING BAFFLES in SEDIMENTATION TANKS

THE recent address of Dr. Abel Wolman setting forth some things which the Sewage Federation might consider in the next twenty-five years was most interesting and worth while. I was particularly impressed with his remarks on one of my pet hobbies—sedimentation tanks. I agree with Dr. Wolman that we may be able to reduce the settling time from "two hours detention" to 30 minutes actual flow time. All we need to do is to control accurately the complete flowing zone and eliminate useless dead water.

The standard procedure for determining settleable solids in sewage, by which we are able to judge the efficiency of any sedimentation tank, is to allow a sample to stand in quiesence for one hour. This means that the heavier solids go down 12 to 14 inches and the solids lighter than water rise to the top. Thus we may assume an average settling rate for sewage as 1 inches in 5 minutes or 6 inches for 30 minutes. This may vary for some sewages and it certainly will for industrial wastes.

For our present discussion we may omit all reference to preliminary treatment appurtenances, such as grit chambers, bar screens and comminutors. Much has already been written on these appliances as well as upon the ratios of tank width to length and depth, and also on the difficulties of placing fixed baffles where they will not defeat the purposes for which they were intended.

F. E. DANIELS,

Consulting Chief Chemist,

Pennsylvania Department of Health

We may also omit reference to the many types of inlets formerly in use and come to the present practice of using inlet distributing weirs and outlet collecting weirs in connection with some scraping mechanism for the continuous removal of the settled sludge.

Let us take, solely for example, a tank 10 feet wide and 20 feet long between inlet and outlet weirs. Such a tank will hold approximately 1500 gallons per foot depth. If we make our cross scrapers 6 inches deep, on the top run from the tank inlet to the outlet they will form a series of moving baffles extending from the top to the bottom of a flowing zone of water 6 inches deep. A period of 30 minutes will suffice for this zone to clarify. Therefore the rate of baffle movement will be 20 feet in 30 minutes or 8 inches per minute, which means a displacement of 750 gallons of water in the moving zone or 36,000 gallons per 24 hours for the tank.

If, however, there is sufficient variation in flow to cause eddy currents, the rate of movement of the mechanism must be so regulated as to conform to the rate of flow of the water.

the baffles on the top run and dropping over on the bottom run while scraping sludge.

It would not be difficult to construct a transparent working model of such a tank and mechanism to show by actual experiment what would occur.

Rectangular tanks equipped with rotary sludge collectors have not yet been considered as that is another problem. In circular radial flow tanks, spiral baffles may be floated on the water surface and moved around the tank by means of the revolving mechanism for the scrapers. The baffles will control the flowing zone and prevent short circuits or unequal flows due to stratification as often seen when colors are used in making observations. It must, however, be admitted that stratification is not serious if the strata are thin. On the other hand short circuits may be very serious.

Since, in circular tanks, top and bottom movements are in the same direction shallower depths than in rectangular tanks may be used. In the two story tanks when there is no moving mechanism to collect sludge, the addition of moving baffles would depend upon the necessity therefor.

It seems to the writer that if serious consideration be given to these data, what is already available may be used to better advantage; money and material may be saved in construction; and dead water which gets foul may be prevented. This would be quite a con-

(Continued on page 118)

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APWA news

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• New Orleans Municipal Auditorium, Site of 1953 APWA Congress

Entertainment, Question Tables, Symposiums, Inspection Trips, to Feature October Congress

Record Attenance Forecast for APWA Congress and Equipment Show
To Be Held in New Orleans, October 26th to 29th

A DVANCE indications point to a record attendance at the 1953 Public Works Congress and Equipment Show to be held in New Orleans, October 26-29. Forty-five exhibitors have already acquired space to display a wide variety of public works equipment at this outstanding show of shows.

Among the exhibitors are many firms that regularly advertise their products in Public Works Magazine, these include in addition to the Public Works Journal Corporation itself; Armco Drainage and Metal Products, Inc., Austin-Western Company; Barber-Greene Company; Centriline Corporation; The Conveyor Company; Dempster Brothers, Inc.: Flexible Sewer-Rod

Equipment Company; International Harvester Company; The Jaeger Machine Company; Koehring Company; Natural Rubber Bureau; "Quick-Way" Truck Shovel Company; Tarrant Manufacturing Company and the Tri-Line Company.

The principal features on the program have now been arranged. They include, in addition to the

Make Your Hotel Reservation Now

The Association has been allotted several hundred rooms in six top hotels. Requests for reservations should be addressed to: Chairman of the Housing Committee, 1953 Public Works Congress and Equipment Show, Room 415 City Hall Annex, New Orleans 12, Louisiana.

For further details write to the APWA Headquarters, 1313 East 60th Street, Chicago 37, Illinois.

business meeting and annual banquet, a scenic tour of enchanting New Orleans and the traditional get-acquainted party aboard the SS. President, on the opening night; also a series of inspection trips and a shore supper at the New Orleans Yacht Club on Lake Pontchartrain.

Highlighting this year's program are three symposiums—"Composting As A Method of Garbage Disposal", "Intergovernmental Relations In Public Works", and "Per-(Continued on page 106)

ROGERS NAMES NEW RESOLUTIONS GROUP FOR 53 CONGRESS

Walter A. Devine Heads Committee of Four Members

Association President, Allan H. Rogers, Director of Public Works, Garden City, New York, recently appointed the following members to serve on the Resolutions Committee: Walter A. Devine, Director of Public Works, Brookline, Mass., Chairman; James W. Morgan, Mayor, Birmingham, Alabama; Reed Mc-Kinley, Director of Public Works, Kansas City, Missouri; Crawford M. Dixon, Director of Public Service, Boulder, Colorado.

President Rogers is an ex-officio member of this Committee which is to consider and report on all resolutions to be presented at the annual business meeting of the Association at the forthcoming Public Works Congress and Equipment Show in New Orleans.

No. California Chapter Elects White President

At the annual business meeting of the Northern California Chapter held in Oakland, Albert C. White, Assistant Director of Public Works for Richmond, was elected President of the Chapter for the 1953-54 term succeeding Walter R. McLean, Supervising Civil Engineer for the East Bay Utility District at Oakland. Richard F. Lovejoy, Director of Public Works for San Leandro, was elected Vice-President and John A. (Continued on page 106)

Write for Details about APWA Membership Today

Each month special news items are included in this column to acquaint our readers with the activities and nature of services rendered by the APWA. Supplemental information concerning items appearing in this column is presented in the Association's Newsletter. Find out about the advantages of the \$10. membership today by writing to the Executive Director, 1313 East 60th Street, Chicago 37, Illinois.

No. California Elects (Continued from page 105)

Morin, newly appointed City Engineer for Oakland was elected Secretary-Treasurer. Following the election of officers, a representative of the Asphalt Institute led a discussion on Asphaltic Concrete vs. Plant Mix. The next meeting was scheduled for August.

October Congress

(Continued from page 105)

formance Budgeting In Public Outstanding authorities Works". with wide experience will discuss these featured subjects of interest to public works officials. In addition, twelve. "What's Your Question" tables have been arranged to give members the best possible opportunities to obtain answers to a wide variety of questions. Six of these tables will be running concurrently on both Tuesday afternoon and Wednesday morning, with a general topic assigned to each group. Well qualified "experts" will staff each table and be assigned sub-topics so that members will know exactly where and when to present their questions. The general topics assigned to these groups are: Street Design and Construction; Personnel Administration; Refuse Disposal; Public Works Financing: Public Relations; Subdivision Developments; Street Maintenance and Repair; Refuse Collection; Parking Facilities and Traffic Controls; Drainage; Equipment Management and Street Sanitation. These topics were selected as those most frequently requested in interviews with members from each of the 48 states.

Two papers are also to be presented, one "Street Uses" by George M. Babbe, Engineer, Southern California Gas Company, Los Angeles, California, and the second "Some Principles In Design and Operation of Municipal Incinerators" by William S. Foster, Engineering Editor, The American City Magazine, New York, New York.

Movie of the Month Is On Construction Safety

"Good Housekeeping—For Men Only" is the name of a new film recently produced by the Aetna Casualty and Surety Company. This is a color motion picture dealing with safety in the construction industry. It has been produced primarily for showing to supervisory personnel and emphasizes the importance of good housekeeping as part of a comprehensive safety program.

This film is available for showing without charge, and may be ob-

tained upon request to the Company's local representatives throughout the country, or by writing to: Public Education Department, Aetna Casualty and Surety Company, Hartford, Connecticut.

Chicagoan Wins Equipment

William Schmidt, Foreman of Machinists of the City of Chicago's Bureau of Equipment was the recipient of a bronze plaque, awarded by the Chicago Metropolitan Chapter, at its spring meeting for the best home developed equipment displayed at its annual Equipment Show. The award, the first of its kind-was made to the developer of the equipment which best reflected ingenuity in design and construction, probable general usefulness and adaptability for development and manufacture. The Awards Committee selected the abrasive spreader designed by Mr. Schmidt.

Cost Reduced on Septic Tank Installation



TWO construction firms in Memphis, Tenn., are cutting costs and speeding up work with a novel application of excavating equipment. The A & P Construction Company and the A. Erwin Company have used the Drott Bullclam Shovel for septic tank and disposal field construction with very satisfying results.

Working on a large addition to Memphis' White Haven Park, these companies have contracted to build 200 septic tanks complete with disposal fields. Each field consists of a network of trenches four feet deep and three feet wide. After excavation, a layer of pea gravel 12 inches deep is laid on the floor of each trench. Then one-foot lengths of 4-inch cement pipe, with ends spaced one inch apart, are laid on the bed of gravel. Tar paper is placed over each joint and then another 12-inch layer of pea gravel (Continued on page 116)



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C-P-P

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Cleveland's Fire Chief knows how vital bigh capacity can be in a water line. Not long ago he said:

"Of the seven major factors in grading a city (for insurance), the most important is

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Fig. III
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Washington



news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association,

THE President signed a watered-down version of the Defense Production Act a few hours before midnight on June 30. The new authority extends to June 30, 1955, and is a far cry from the economic and materials controls formerly exercised by the President and somewhat less than the Eisenhower Administration requested from Congress.

Controls in the new law are limited strictly to materials. The only projects for which priorities will be issued are those for defense production. The new Act contains priority assistance for states or cities, as such. The American Municipal As-

sociation, however, has received assurances from Defense Mobilizer Flemming that consideration for priority assistance will be given to cities when "the construction project directly affects defense production." Thus public works officials can only look for priority assistance when material shortages threaten disruptions in work related to defense production.

Allocations of materials will be only for defense projects.

National defense projects, as defined in the new law, are limited to military production, atomic energy production, foreign military aid and stockpiling of military materials.

Federal Reserve Bank Estimates \$100 Billion Backlog in State and Local Public Works Needs

The Federal Reserve Bank of Chicago recently estimated the backlog in state and local public works at \$100 billion. The report pointed out that the capital construction needs of cities and states fall into three categories: replacing facilities that will become obsolete during 1953-60, adding to facilities to take care of the expected continued shift from rural to urban

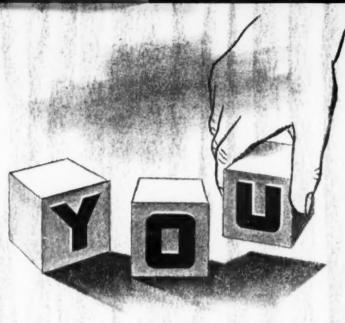
areas and from large cities to the suburbs; raising the standards of service by eliminating accumulated deficiencies and improving existing facilities. The principal public works areas making up the backlog, in order of dollar volume are: roads and streets, schools, water and sewer systems, hospitals, airports and finally all other types of public works.

Expenditures for Public Construction to Hit All-Time Peak in 1953

Based on expenditures for state and local public construction during the first five months of 1953, public construction expenditures for 1953 will hit an all-time peak of around \$6 billion. State and local contributions for construction under Federal-aid programs, as well as total expenditures for state and local construction financed independently of such programs during the first five months of 1953, shows a gain of 2.1 percent over the same period in 1952. Expenditures in 1952 were higher than in any previous year. During the first five months of 1952,

state and local expenditures amounted to \$2.072 billion. For the same period in 1953, expenditures totaled \$2.115 billion.

The breakdown of this record expenditure for public works during the first five months of 1953 is as follows: residential building—\$231 million; nonresidential building—\$914 million (educational—\$346 million, hospital—\$126 million, all other \$142 million); highways—\$594 million; sewer and water—\$285 million, and all other construction including airports publicly owned utilities, parks, etc., \$86 million.



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The wholesaler tries to do more than just sell. He tries to give you hints on material conservation — ideas to show you how to make your supplies go further. He tries to be the first to show you a new product, or a new technique, which will save you time and money. And, conversely, he steers you away from "blue sky" products with intangible worth.

Outside of his office, you can see the wholesaler assuming an active role in community affairs — in church, in neighborhood clubs, in charities. These are the times the "YOU" attitude means devotion to fellow men and their problems.

Yes, the wholesaler is quite a guy. Most of the good things in the American way of life are as a result of the activities, not only of wholesalers, but the plumbers, refrigeration service engineers, and others.

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SEWER MAINTENANCE: Sewers Are Full of Surprises

ROBERT POSS.

City Engineer, Marinette, Wisc.

A LL too often when we see a sewer backfilled, we breathe a sigh of relief and say to ourselves: "Well, we're through with that sewer." We are wrong, of course, because a sewer, like any other structure, requires maintenance from the day construction is completed. The poorly maintained sewer soon forces itself on the attention of the community.

Sewer maintenance includes checking the condition of pipes and joints; cleaning the sewer lines of obstructions; preventing gas accumulations and explosions; supervising the installation of new connections; and repairing cracked and broken pipes.

Why is sewer maintenance of interest to plant operators? In the first place, some of them are charged with sewer maintenance as well as sewage treatment plant operation; others are interested because of the effect of sewer maintenance, or lack of it, on plant operation. When sewers are partly clogged, the sewage arriving at the plant will be more difficult to treat.

There is now some tendency to eliminate the grit chamber at the treatment plant. I am one who believes a grit chamber is a "must" in any plant. Omission of a grit chamber is based on the assumption that no sand enters a sanitary sewer; but you get sand in any and every sewer system, particularly where there are broken pieces of pipe, poor connections to houses, or leaky joints. You will realize how serious this sand problem is if you draw the job of cleaning the sand from a digester -a job we do periodically at Marinette. But even if you have a grit chamber, you can improve plant operation, save wear and tear on the pumps and steer clear of cleaning digesters by getting the sand while it is in the sewers and before it reaches the plant.

Good sewer maintenance has its beginnings in good design and good construction. Using a poor grade of pipe or pipe that is too large for the flow; permitting poor joint construction; designing manholes poorly, especially the flow lines; using grades that are too flat; providing insufficient cover so that the lines break under traffic or freeze—all of these are factors that make expensive maintenance necessary. Add to these, improper bedding, careless construction of wye connections and the lack of supervision over plumbers who cut-in laterals at other places than at wyes, and the necessity for good maintenance is even greater.

But whether the original design and construction were good, you are stuck with the maintenance, so let's talk about that. We have a maintenance problem as tough as any in Marinette, so I'll describe the way we handle our job.

We have, for the most part, a combined sewer system; only the sewers laid during the past 15 years or so are separate sewers, and these are but a small part of the total footage of lines. So we have sewers that are too large for dry-weather flow and too small for anything greater than a heavy dew. Then we have lots of elms, soft maples, box alders and Balm of Gileads planted in the terraces, so we have a root problem. The soil is largely sand and our plumbing inspection hasn't been too good, so we have a sand problem. And we have some broken

Normally in a sewer inspection program a sewer inspector makes periodic inspections, mainly at the

New Drilling Device Speeds Stump Removal



Courtesy, Toledo City Journal

DUE mainly to the Dutch Elm disease taking its toll on the city's beautiful trees, Toledo's forestry program is faced with the problem of removing more than 1.200 stumps in the speediest manner possible.

After studying the different methods of stump removal used in other cities, the stump remover shown in the accompanying photo was purchased. This device, mounted on the rear of a Caterpillar D2 tractor, operates through the rear power takeoff. Three cutting tools are used in the operation. In the first step, a 2½-in, drill makes a start on

the stump. This is followed by an 8-in. drill, and finally a 15-in. cutting tool is used to drill about five inches below the ground surface. Chips fly as the drill is moved around the stump, making six or seven drillings, depending on the size of the stump.

In the first three days of operation an average of five to seven stumps a day were removed. In the past it was difficult to remove two stumps a day with a crew of five workmen. Cost of the new tools, including stump remover, tractor and trailer was \$18.400.

manholes, to see that the flow lines are clear and there is no build-up of sewage. If there is an accumulation at a manhole, cleaning the manhole and the pipe a few feet beyond the manhole may restore free flow. The line may be "lamped" for a final check. Usually it will be unnecessary to enter the manhole, for if the line is flowing freely, the sewer is, in all probability, unobstructed.

But that is not the case in Marinette; we have to clean all of our sewers, and our program is a continuing one.

Without mentioning brand names,

we acquired power winches, steel rods 3 ft. long, root cutters and suction cups. These are sometimes enough. In many cases we put a suction cup on the end of the rods and clean an entire block of sewer. We have cleaned lines as large as 10-inch with one pass. If we find there is much sand in the sewer, we run the rods through to the next manhole, pull a cable through, using one or two power winches and hook on a special sand bucket; and we keep on with the bucket until the line is clear.

An advantage of this system is

that, except for cleaning the manhole and installing the guide sheaves for the cable and the bucket, all work can be done above ground; time spent in the manhole is at a minimum.

The work isn't all as easy as this. Many times we encounter roots in such profusion that we cannot penetrate the growth; or we find so much sand that the auger cannot be forced through. Then we use a power drive, but sometimes we have had to dig up a section of sewer to clear sufficient pipe so we could get our rods from one manhole to the next.

For handling roots, we have a cutter that is adjustable from 6 to 12 ins. and has a profusion of knives. We drag this through the sewer with power winches and at times we have had it come out of the line so covered with roots that it reminds us of the chin foliage on the Smith Bros.

Once we have cleaned a sewer, we usually flush the line if water is available to make sure that we have removed all of the sand and dirt. This isn't strictly necessary if the job of bucketing out the dirt and sand has been well done. Some cities also put through a brush to remove slime or fungus growth on the interior of the pipe. We do not have such a problem.

Our sewer cleaning program is organized as follows: We give the squad leader, who is usually the truck-driver, a map of the area where sewers are to be cleaned. On this map we show the distance between manholes and the size of the pipe. He starts at the upper end of one of the branches and continues through the branches to the trunk sewer. Each tributary line is cleaned before cleaning the main below. This assures us that no new accumulation of dirt from a tributary will reach a recently cleaned portion of main.

Our map is covered with a transparent overlay, and when a sewer has been cleaned it is marked with the date and with any pertinent data that might influence the checking of the line or indicate the need for rebuilding. We keep a record of obstructions and root conditions. If we find a break in a pipe, we bring in another crew immediately to make the necessary repair. Often we find that a house lateral projects into the main. Our cleaner does a lovely job of chewing off the offending lateral; but then we've got to dig down and check to see what damage was done and also see that a better connection is made. We can





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Product

usually locate a break or other trouble within a foot or two by marking the cable or the rods and then measuring.

One of the most distressing events is to pull up a bucket and find in it a piece of sewer pipe with a fresh break or fracture. If we have hit something, we can tell quite closely where the break is; but if we haven't, the problem of where the trouble is may be embarrassing.

Where the problem is due to roots only, copper sulfate is very helpful. Because we have a combined system, we have had only limited success with this method, but it has proven itself in house laterals. We give it to the householders to use and it has worked very well.

Maintenance Hazards

The maintenance of sewers is not without hazards. In opening a sewer trench, a cave-in is always one of the dangers. This can be minimized by the use of properly installed sheeting. There is also the danger of slipping and falling from the steps set in manholes. We no longer rely on such manhole steps, but use a steel ladder, which we find much more practical. Infections are always

a danger and there should be a kit handy for prompt treatment of cuts, bruises and abrasions. We always furnish rubber gloves, but the men are reluctant to use them. It is good to have clean water and strong soap along for hand washing. Another danger lies in the gases that may accumulate in a manhole, either explosive or otherwise dangerous.

Two safety devices should always be at hand. One is a harness that a man wears when he enters a manhole. A rope is attached to this and the end is held at the surface. If a man has to be helped or lifted out of a manhole, this can be done from the surface. Most men don't like to use this harness and won't unless they have to. The other safety device is an explosimeter which indicates when a combustible or explosible mixture of gases is present.

I do not hold that we have the best system of sewer maintenance, but we do have an effective one. During my first year in the program, in 1947, with wooden sticks and hand powered winches we cleaned 11,000 ft. of sewer, using a 5-man crew at an average cost of 26 cents a foot. We bought power equipment, raised the pay from 75

cents to \$1.12 per hour and last year cleaned 26,000 ft. at an average cost of just under 11 cents a foot.

Much of the success of a sewer maintenance program depends on the personnel of the cleaning crew. Good, husky boys with a lot of enthusiasm for doing this type of work, plus a pay incentive, have made it possible for us to get these results. This isn't the cleanest job in our organization, but we have no trouble in filling a vacancy in our crew. We have good equipment, we furnish our men with oilskins and rubber gloves—but we can't always get them to wear these—and we pay them well.

The work is always interesting, for these sewers are full of surprises. We all like to be around just to see what will happen next.

This article is based on a paper presented by Mr. Poss at the Wisconsin Sewage Works Operators' Conference held at Madison.

Rubber Lining a Reservoir

A few months ago we referred to a project for lining a reservoir with rubber at Sunderland, England.



Because of coal mines below, there was slight subsidence of the clay between the reservoir and the rock above the mine, which caused constant slight settling and the formation of fine cracks in the reservoir. The reservoir is divided into three basins, two large and one small. As a possible remedy, the small one was lined by the Dunlop Rubber Co. in 1951, and the result was so successful that the directors of the water company have asked the same organization to line one of the two main reservoirs this fall. The work will require nearly a ton of adhesive to fasten some 16,000 sq. yds. of very high quality rubber, mainly 1/4 inch thick, to the sides of the reservoir. The rubber bag will weigh 100 tons, and hold 12,000,000 gallons of water.

> Manufactured Sand for Asphalt Pavements

There is a scarcity in San Francisco of sand suitable for use in asphalt pavement mixes and the commercial asphalt plants find it difficult to control mixes due to the variation in the grading of the sands used. A manufactured sand, made by crushing oversize top sand in a rod mill, was placed on the market for use in asphalt mixes, which, according to the 1952 report of the city's Bureau of Engineering, "works well but carries an excess of dust and is difficult to handle in unloading unless special facilities are available."

Good Results from a Twelve-Year Old Sewage Plant

THE Gary, Ind., Sanitary District has for 13 years been operating a large (40 mgd) sewage treatment plant; also a small Imhoff tank and trickling filter plant to serve 2,000 population. No additions have been made since the large plant went into operation on Aug. 23, 1940, although the population served has increased from 106,000 to 124,000 and sewage from the steel industries, which formerly discharged into the river, has been diverted to the sewers. During 1952 the sewage flow exceeded the public water supply pumped by 6.6 mgd, and for several previous years had exceeded this slightly.

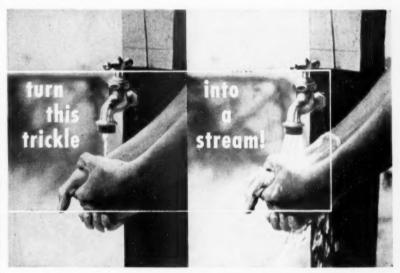
The main plant contains 5 Chicago Pump Co. Comminutors; 2 Link-Belt grit chambers; 4 Dorr clarifiers; 10 aerators with Chicago Pump Co. diffuser tubes; 8 Dorr final clarifiers; 5 heated primary and 3 unheated secondary Dorr digestion

tanks; 65 sludge drying beds; 2 American air filters; 2 Roots-Connersville rotary blowers; 3 Elliott centrifugal type blowers; and 2 Jeffrey garbage grinders, capacity 10 tons per hour each.

This plant has continuously functioned properly and produced a highly polished effluent with low suspended solids and BOD content. Economy in operation has made it possible to reduce the tax levy of the District from 20¢ per \$100 in 1941 to 15.6¢ in 1952. During the first 12 yr. of operation the plant produced 685,657,250 cu. ft. of gas. the value

of which is estimated to be \$276,913, based on the existing rate schedules for a large consumer of purchased gas. This gas has furnished power for 95% of the pumpage, and for 99% of the aeration requirements of 9,019,000 cu. ft. per day.

The 12-yr. averages of purification effected by the plant are: 97.1% removal of suspended solids, leaving 8.4 ppm in the final effluent; and 93.8% reduction of BOD leaving 8.9 ppm in the final effluent. The gas produced last year averaged 1.37 cu. ft. per day per capita, 2.9 cu. ft. per pound of solids added, or 5.5



If loss of pressure is your water problem, the source of trouble may be tuberculation and corrosion in your pipelines. In this case the Centriline process can turn this trickle into a stream . . . and can put smiles back on the faces of the taxpayers of your community.

Centrilining is the application of cement mortar to the walls of pipelines in place, after cleaning. At a fraction of the cost and trouble of replacement, Centrilining extends the life of old pipes indefinitely. For complete information on this time proven process, write for your free copy of Centriline's new booklet.

Pipelines 4" to 14" are cement-lined by the Tate Process.

CEMENT-MORTAR LININGS FOR PIPES IN PLACE



CENTRILINE CORPORATION

A subsidiary of Raymond Concrete Pile Co. 140 CEDAR STREET, NEW YORK 6, N. Y.

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cu. ft. per pound of volatile solids added.

One factory discharges pickle liquor, 4 to 6% acid, from one or more of three tubs of 2,000, 3,000 and 6,000 gal. capacity about every third day. At first this caused trouble by inhibiting biological action in the secondary treatment process, but addition of lime by the industry solved the problem.

Large quantities of grit in the raw sewage resulted in excessive wear in the raw sewage pumps. The impellers lasted only about 3 yr., and replacements cost approximately \$4,000. Experiments with rubber covering of impellers over a period of 3½ yrs. showed that, on the average, rubber covering would cost \$130 per impeller, would increase pump efficiency, and would last about one year. Rubber covering is now maintained on all raw sewage pump impellers.

The piston pins on the five gas engines in the plant wear elliptical. Instead of replacing them, the old pins are machined round and chrome plated to the original diameter, with a cost of just over \$30.00 less than that of a new pin.



Now's the time to mail this month's Reader's Service card.

Testing for Gases in Sewer

In San Francisco, in November, 1951, a Sewer Survey and Gas Detection Unit was formed to investigate the physical and gaseous condition of the sewerage system. This unit consists of a panel truck equipped with detection equipment operated by an engineering chemist. one sewer-cleaner and one laborer. Because of the lack of funds the unit became inoperative in March 1952. but within this four months period 2977 manholes were tested. Of these. 19 manholes showed definite explosive properties, having a content of over 60% of an explosive gas and air mixture. The Pacific Gas and Electric Company is notified when these conditions are detected, so that they may have the opportunity of determining whether their gas lines are leaking. Tests are made at each manhole for the presence of explosive gases, hydrogen sulphide, carbon monoxide and for a deficiency of oxygen. It is the present plan to continue the survey until the entire sewer system is thoroughly investigated and the proper rechecks are made. These data are from the 1952 Report of the Dept. of Public Works of the City and County of San Francisco.

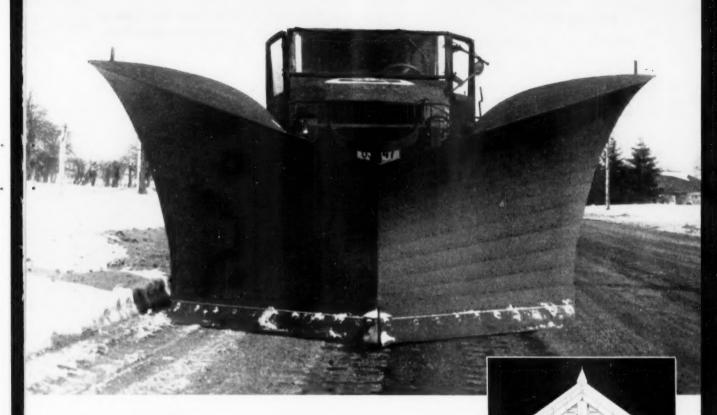
Septic Tanks

(Continued from page 106)

is applied. This forms the absorbtion field. A minimum of 300 feet of trench is laid for each tank.

Two Bullclam Shovels mounted on TD-9 International Tractors transport the pea gravel from stockpile to trench, assuring uniform distribution at all points. This job was previously done by hand labor with shovels and wheel barrows, which besides wasting time and money, slowed down the entire job. The 1-yard Bullclam shovels transport their loads over spoil banks to spot the correct amount of gravel in each trench. The lip of the clam is controlled to regulate the flow of material and amounts can be deposited to the exact specified depth. The machines also backfill the trenches, ther, grade and landscape the finished area.

Since the Bullclam Shovels were put on the job, the work has progressed to the point where one company can finish three tanks per day. Besides placing the pea gravel to exact specifications, these machines also do sewer and foundation work, landscaping, grading, trenching etc.



Face Winter Confidently with Gledhill Snow Plows

When you're backed up by Gledhill plows you have the assurance that your snow removal equipment is tops. From several decades of snow-plow building—as well as building other road machinery—the 1953-54 line of 23 various styles and sizes represents the best that experience and honest endeavor can produce.

Operators like the way they work . . .

The special, crimped moldboard has a way of aerating or breaking up the snow—throws it farther! Skid shoes or casters are easily adjusted for varying surface conditions. As one operator put it—"They sure scour the road!"

. . . and the way they attach

Adaptable to any standard truck, the hitch is sturdy yet simple. Permits ready attaching and detaching. When plow is removed, lift beam and hoist fold compactly within vertical lift frame. "I" beam push frames for greatest strength and durability — heavily braced and welded throughout.

Blade Type

Blade lengths range from $7\frac{1}{2}$ to 12', for plowing widths ranging from 5'9" to 9'10". There's a size and type for most every application. Cutting edge's quality fully meets state highway specs.

See your nearest Gledhill dealer, or, write to the factory for complete specifications and prices,

For 1/4 ton Jeeps up to 12 ton trucks





SIDE VIEW—Shows automatic trip, fold-back hoist, adjustable casters.



"One-way" plow

Reversible or "bulldozer" effect

THE GLEDHILL ROAD MACHINERY CO. · GALION, OHIO

Moving Baffles

(Continued from page 104)

trast to the older tanks, some of which were as much as sixteen feet deep. But we must not forget that in the "old" days there were reasons for deep tanks.

The diagram herewith shows a sketch of a conventional rectangular tank with one type of sludge collecting mechanism. Hinged baffles are attached to the cross flights.

It is not the purpose of this article to attempt to specify how the baffles should be designed to fit the many different patterns of the various companies. That is definitely the problem for the designer of the particular company; but we do wish to emphasize the following basic principles which are somewhat novel:

1. Confine the flow to a definite zone in the tank.

2. Control the movement of all parts of this zone to a uniform rate by means of baffles moving at the same rate as that of the water.

3. Cut down the size of the tank to eliminate as much as possible of the dead water.

Snow and Ice Control in Upstate New York

(Continued from page 75)

erating in various locations in the county. This has effected a considerable saving in time by providing direct communication at all times permitting us to direct men and equipment efficiently in the field. Our foremen are circulating in various areas of the county so that they can communicate from and to the various truck equipment and also from a pick-up truck that is generally in use with one of our general foremen. This permits quick and proper placing of the equipment into the areas where the storm is worst and where the regular equipment may need help; or in case of breakdowns, the substitution of other equipment in such locations. We believe that the expense involved in radio equipment is well justified by the savings and better service which can be given to the traveling public by the use of such 2-way radio.

Our Sno-Go units are used not only for emergencies but also to clean up intersections and to cut back banks to prevent saturation of shoulders from melting snow in the spring. By doing this - widening with the Sno-Gos-we can get melting snow into the ditches and drained off the road, preventing subsequent maintenance troubles in the spring.

While the snow storms are generally light, temperatures remain low at times. After repeated snow storms we have considerable depths of snow aggregating 3 to 4 ft. on the level. This, together with high winds, which prevail in the Mohawk Valley and sweep over the south and west portions of the County, causes a great amount of drifting, and necessitates continual operation around the clock in order to keep the roads in this county clear and open for traffic at all times. This county lies within driving distance of such large industries as General Electric. American Locomotive and the Watervliet Arsenal and we have a great number of people driving through the county to work each day.

In addition to this, we have large lumbering and pulp wood operations in the northwestern section of the county. This contributes to the business life of the county, necessitating clear highways and safe transportation at all times of the day and night. School districts are fairly well



One Man Operation with the CENTURY

You have full control of direction and width of spread; full control for light or heavy spreading; full control of intermittent applications when you use the CENTURY Hydraulic SPREAD-ALL for ice control work.

The CENTURY SPREAD-ALL spinner is positioned at low level, never sprays material on passing cars. And spinner is always parallel with pavement regardless of elevation

The truck driver alone operates the CENTURY SPREAD-ALL. Truck maintains traffic speed even during intermittent sanding at bus stops or intersections.

Takes only 5 minutes to detach. Mounting bracket cannot interfere with other truck

Only CENTURY GIVES YOU THESE 3 Big Advantages:

- Unit is engineered to fit the tail-gate of any standard dump truck without altera-
- Spreads bulk, salt, calcium chlorides, such as Dowflake and Peladow four traffic lanes wide while driving at traffic speed down
- Spreads as little as 300 lbs. per running

REPRESENTATIVE USERS OF CENTURY SPREADERS

STATE HIGHWAY DEPARTMENTS: Montong.

Illinois, Kansas, Wisconsin

MUNICIPALITIES: Detroit, Michigan, Cincinnati,
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OTHERS: The Chicago Transit Authority (Exclusive Century), The Edison Company, The Wyandotte Chemical Company, Ford Motor Company (Proving Grounds), Seneca Petroleum,
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Send for fully descriptive folder and prices. You'll see why city after city is specifying CENTURY. Send a post card today.

Century Spreaders — Hydraulic Pumps — Hydraulic Motors and Valves WAUKESHA, WISCONSIN



LOAD-PACKER loads and compacts ALL refuse



GAR WOOD

Wooden crates, discarded furniture, worn out an rolled-up rugs and mattresses—these ful new Gar Wood Load-Packers load and ze hopper. This distinctive Load-Packer fea-means faster, more economical and more ofe refuse collection on every trip. There's ed to send an extra truck to pick up refuse



- Larger capacity, topered body
- Lower, wider loading hopper
- Fully-automatic finger-tip control
- Streamlined, leakproof design
- Improved hydraulic dumping
- Lower maintenance costs

too bulky for conventional loaders . . . there are no costly delays while crew breaks up boxes, crushes big cans and drums or smashes discarded household effects. Load-Packer's powerful hydraulic pressure compresses and compacts all refuse into a solid mass within the body.

Big, wide-opening side doors, too, are standard equipment on all Gar Wood Load-Packers. Refuse too bulky or too long for even the big Load-Packer hopper can be loaded through these convenient doors. Thus selective loading is eliminated—nothing is left for householders to dispose of themselves. Complaints are reduced and service and public relations improved.

You can do a real service for your tax-payers by putting Gar Wood Load-Packers to work in your community. Join the thousands of other cities, towns and villages that depend on Gar Wood Load-Packers for fast, efficient, economical refuse collection. Get the Load-Packer story today!

CHECK THESE LOAD-PACKER EXTRAS:

GAR WOOD INDUSTRIES, INC.

Customer Service Dept. Gar Wood Industries, Inc. 36013 Mair St., Wayne, Mich. Please send me the Loud-Packer story on faster, more efficient refuse collection. Hame and Title.

WAYNE, MICHIGAN

centralized in this county, requiring the continuing operation of hundreds of school buses over our roads. All of the above combine to demand continual and efficient operation to provide clear and safe roads for the traveling public for each and every kind of business, industry and pleasure. The daily lives of our people are so dependent upon highway transportation that safe roads are a necessity in the winter as well as the summer. Therefore, winter maintenance is with us continually and methods of such maintenance must be continually improved.

New Hampshire Winter Maintenance

(Continued from page 74)

expended for winter maintenance on the 3,238 miles of the State Highway System. The average cost was \$656.16 per mile. Equipment, material and personnel are the main items in this cost. The state operated a total of 100 trucks and hired an additional 254; 7 power graders, 362 plows, 314 wings and 302 sand spreaders were in opera-

tion; 70,833 cubic yards of sand and 36,370 tons of chlorides were used. In addition 1,024,374 linear feet of snow fence was installed.

The state operates a night weather patrol when weather conditions require this service. This past winter the patrol operated an average of 120 nights and 2 243 patrolmen were called out on from 31 to 62 nights depending upon the amount of ice and snow in different parts of the state; 291 motorists were assisted by the night weather patrol.

While it takes a lot of money to remove the snow and ice, it is a service which the public demands and for which they are willing to pay.

A <u>LEADER</u> OUTPERFORMS!



HI-WAY Spreader MODEL DD

This all-season portable tail-gate spreader may be mounted on any standard dump body in a matter of minutes. It gives a uniform spreading pattern of 4 ft. to 60 ft. for seal coating in the summer and ice control in the winter. The "DD" spreads uniformly at truck speeds of 1 to 35 m. p. h. in any gear, using sand, salt, cinders, chips or chlorides. Powered by a rugged 2 h. p. gas engine, the "DD" is built to give years of economical service.

HI-WAY Spreader MODEL E

Here's one-man operation in a truck-mounted sand, salt and cinder spreader—for real performance with a minimum of labor. Controls conveniently located in the truck cab. Gives uniform spreading pattern on 2 or 4 lane highways at speeds of up to 35 m.p.h. with sand, or chips for seal coating in summer—salt, cinders or chlorides in the winter—gravel or fertilizer when required. The Model "E" is available with separate motor drive for distributor disc or power take-off operation. In sizes up to 7½ cu. yd. For larger capacities up to 12½ cu. yd., the deluxe Model "W" is available.





Manufacturers of the World's Most Complete Line of Spreaders and Bulk Material Delivery Equipment

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Tarboro Power

(Continued from page 79)

the economical fuel if present efforts to secure a gas supply are successful.

Present fuel savings accrue from two sources; increased output in terms of kilowatt hours per gallon of fuel, and lower cost per gallon. Analyses of fuel consumption show that the Worthington units average 14.4 kilowatts-hours per gallon on heavy oil. This figure compares favorably with the 13.4 kilowatthours per gallon obtained by the same units with the light oil. Also favoring the use of heavy oil is the 4.1¢ per gallon price differential which prevails at this writing.

Specifically, the new engines produced in the fiscal year ended June 30, 1952, a total of 12,034,800 kw. hr., while consuming 705,039 gal. of heavy oil and an estimated 146,247 gal. of light oil. The units generated approximately 84 percent of their total production on heavy oil, the rest on light. Fuel cost per kw. hr. is 5.1 mills on heavy oil compared with 8.5 mills for the same engines on light oil. Thus, the use of No. 5 fuel results in a saving of 3.4 mills for each kw. hr. produced with the heavy oil, or a saving of \$34,000 on fuel for the year.

The fuel savings achieved at Tarboro have made possible a recent reduction in rates to the consumers, always welcome and particularly so at a time when other consumer costs are rising.

The municipal electric department is operated by Manager R. M. Weatherly, under the supervision of Mayor H. I. Johnson and two Commissioners of Light and Power, R. M. Fountain (Mayor Pro Tem) and Dr. E. L. Robertson.

HERE'S THE ANSWER to your Sewer Problem





STANDARD ARMCO PIPE* is used for sewers of normal size. Positive bolted couplings join 20-foot sections. Pipe diameters range from 8 to 96 inches.

One of these five Armco Sewer Structures will solve almost any sewer problem. They differ in size and shape, but all give you the advantage of sturdy corrugated metal design. Installed cost is low, and the work goes fast.

Write for more details on specific applications. Armeo Drainage & Metal Products, Inc., 4183 Curtis Street, Middletown, Ohio. Subsidiary of Armeo Steel Corporation. Export: The Armeo International Corporation.

*Supplied as Asbestos-Bonded for severe corrosion and Paved-Invert for erosion.





STANDARD PIPE-ARCH* is designed to provide greater capacity under limited headroom. Sizes: from 18" span by 11" rise to 72" span by 44" rise.





MULTI-PLATE PIPE is for larger structures. Assembled by bolting together pre-curved corruga(ed plates. Diameters range from 60 to 180 inches.



MULTI-PLATE PIPE-ARCH combines advantages of MULTI-PLATE and Pipe-Arch under limited headroom. Sizes are from 6'-1" by 4'-7" to 16'-7" by 10'-1".





MULTI-PLATE ARCH may be installed on concrete or masonry base. It provides a low, wide waterway. Spans range from 5 to 30 feet.

ARMCO SEWER STRUCTURES



PUBLIC

WORKS DIGESTS

THE WATER WORKS DIGEST

Radioactive Fallout in Massachusetts

To what extent has radioactivity of waters in Massachusetts been increased by fission products produced by the nuclear weapons tests made in Nevada, and how effective are self-purification mechanisms in reducing the activity? The answer has been sought by scientists of Harvard University. Samples from waters within an area of 1,000 sq. mi. have been tested weekly since April 26, 1952 for gross beta-gamma activity. It was believed that fission products caused by the Nevada test of June 1 and projected into the upper air, were carried eastward rapidly, and were carried down in Massachusetts by rainfalls there on June 2, 4 and 5. The counts per minute per liter increased from 1 or 2 on June 1 to 30 on June 11 and decreased again to 2 by July 1. 30 cpm is smaller than any tolerance value except that of radium. Fallout disappears more rapidly in surface waters than may be accounted for by nuclear decay alone, probably because they settle to the bottom, are diluted by stream flow, and by biological uptake.

"Radioactive Fallout in Massachusetts Surface Waters;" by Harold A. Thomas, Jr., R. Stevens Kleinschmidt, Frank L. Parker and Carlos G. Bell, Jr., Div. of Applied Science, Harvard Univ. Journal Am. W. W. Ass'n, June.

Steel Tanks as Distribution Reservoirs

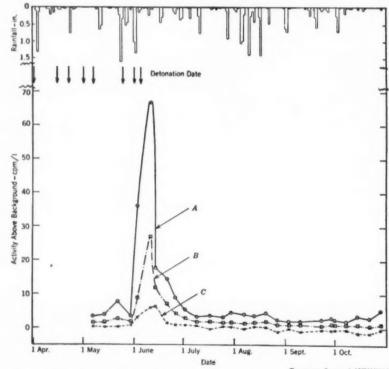
Long Beach, Calif., has for its water supply a storage capacity of 100 million gallons located on two hills. Instead of constructing large concrete reservoirs, as was at first proposed, discovery that the land had settled 6 in. in 5 yrs. caused a change of plans to steel reservoirs. Thirty 31/2 mil. gal. steel tanks are now in use, six of which are now 21 vr. old and have passed undamaged through an earthquake. The author feels justified in considering the modern steel tank to be permanently watertight, comparatively safe against earthquake, requiring very little maintenance if ordinary precautions are taken, and less expensive than most concrete reservoirs.

"Advantages of Steel Tanks as Distribution Reservoirs;" by C. Kenyon Wells, Asst. Gen'l. Mgr., Long Beach Water Dept. Journal. Am. W. W. Ass'n, June.

Disposal of Water Plant Wastes

Wastes from water treatment plants are of three general kindsthose from settling basins, from lime-soda ash softening, and from zeolite softening. Sludge from settling basins is usually released to a stream at periods of high flow or is used as fill. That from limesoda softening is usually greater and unsightly. It consists principally of calcium carbonate. It is possible to recalcine the sludge; or use the sludge as a precipitant in primary sewage treatment plants; or dewater, dry and pulverize for sale to industry. In a few cases it is discharged to sewers, but this may cause trouble in the treatment plant. Discharge to sludge beds or lagoons is quite common. Lagooned sludge has been used to backfill around water mains to protect them from external corrosion; in others it has been used by farmers. Recalcining has been adopted by a few large plants, and recent designs suitable for small plants are being tested.

Wastes from zeolite softening plants include chlorides from the



RADIOACTIVITY in Massachusetts surface waters, 1952



Lishographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

THIS ILLUSTRATION showing the installation of U.S. mechanical joint pipe in a residential area is a typical scene. It could be either a water, gas or sewer line installed to furnish reliable utility service for present and future generations in the community.

U.S. cast iron pipe centrifugally cast in metal molds is a quality product produced by a modern casting process which is carefully controlled from raw material to the finished pipe.

We are well equipped to furnish your requirements for cast iron pipe and fittings made in accordance with American Standard, American Water Works Association and Federal specifications. U.S. pipe centrifugally cast in metal molds is available in sizes 2- to 24-inch and pit cast pipe in the larger sizes.

COST ITON
PILL
FOR WATER, GAS, SEWERAGE
AND INDUSTRIAL GERVICE

Our General Office is now located in Birmingham, Ala., instead of Burlington, N. J.

United States Pipe and Foundry Co., General Office, 3300 First Ave., N. • Birmingham 2, Ala. Plants and Sales Offices Throughout the U.S.A.

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salt used in regeneration, which may kill fish if discharged into a stream in slugs. Possibilities include evaporation ponds and disposal wells, but either may contaminate underground water.

"Disposal of Wastes from Water Treatment Plants;" by H. H. Mace. PUBLIC WORKS, July.

Controlling Algae and Duckgrass in Reservoirs

Los Angeles' water department has 26 open reservoirs ranging in capacity from 9.4 to 183,500 acrefeet. It uses copper sulfate for controlling algae growths and duckgrass, and has developed methods and equipment for effective and rapid application of it over large areas. Until 1952 the distribution was effected by a blower type machine, but this is used now for small doses for treating growths in the top levels of the reservoirs. The blower blows copper sulfate snow into the air and wind currents assist in spreading it over the surface. With wind blowing 10 to 15 mph steadily from one direction, a high rate of feed over wide lanes is obtained: 5 tons has been distributed over 1800 acres in $4\frac{1}{2}$ to 5 hours. The blower needs continual adjustment by a trained operator and favorable wind conditions, and some of the copper sulfate may be blown onto the land.

A belt conveyor machine was first used in 1952. It allows a range of feed from 1.2 to 200 lb. per minute, feeds very evenly into the propeller wash of the boat and is independent of wind. By it, 5,000 lb. was applied uniformly as to both surface and depth over 120 acres in 2 hours. It is used also for applying powdered alum to an open reservoir.

Duckgrass or pondweed is controlled and all but eliminated by maintaining a constant residual of 1.0 to 0.6 ppm of copper sulfate, feeding a solution of copper sulfate into the inlet during the growing season. Where this is practiced, periodic treatment for algae control has been eliminated. Detail descriptions are given of the construction of both blower and belt conveyor.

"Reservoir Treatment by Improved Methods;" by Ray L. Derby, San. Engr., and Fred W. Townsend, Water Treat. Operator. Water & Sewage Works, June.

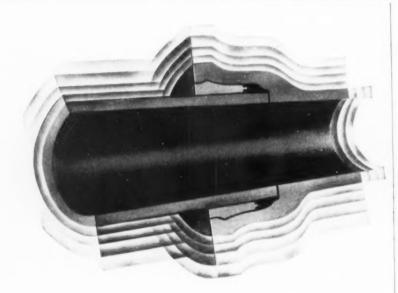
Metallizing Steel To Prevent Corrosion

It is claimed that metallizing steel water tanks with zinc will retard corrosive attack for longer-term, maintenance-free service than any other currently used system. Two tanks in Buffalo, N. Y., were metallized in 1934 with zinc to a coating of 0.008". In 1950 there still remained a coating of 0.006" of zinc and no trace of corrosion was found anywhere. It is estimated that the protection will continue for a total period of 48 years, with no maintenance treatment meantime.

"Prevention of Corrosion by Metallizing;" by J. W. Stanley. Maine Water Utilities Ass'n, May.

Municipal and Home Water Softening

Municipal plants usually soften water to about 85 ppm only. By use of home softeners this remaining hardness can be removed. The 85 ppm remaining after municipal hardness reduction has a minimal tendency to form bathtub rings, produce some sludge or scale in hot water tanks, form a sticky rather than soft lather, and other disadvantages. Used for treating water with more than 125 ppm hardness, a family of 4 would have to have its unit freshly charged every 4 weeks. If the water treated by home soft-



A JOINT THAT KEEPS ITS HEAD ...under STRESS and VIBRATION

Long after you backfill the trench, water pipe joints poured with ATLAS MINERALEAD® provide leak-free performance without maintenance . . . protected by a bond permanently able to withstand stress, vibration and deflection.

This plasticized, sulfur base compound flows freely . . . handles easily . . . seals to a leakproof bond without caulking. In addition, ATLAS MINERALEAD melts without bubbling or frothing or settling out in the melting pot. Both time and material are saved at every step of the jointing procedure . . . as proven by over a quarter of a century of usage.

YOU SHOULD HAVE THE FACTS. Write now for Bulletin M10-1A on MINERALEAD.

OTHER ATLAS PIPE JOINTING MATERIALS For Cast Iron Water Pipe: HYDRORINGS®. For sewers: JC-60®, GK®, SLIPJOINT GK®.

ATLAS JOINTING COMPOUNDS
...a permanent bond

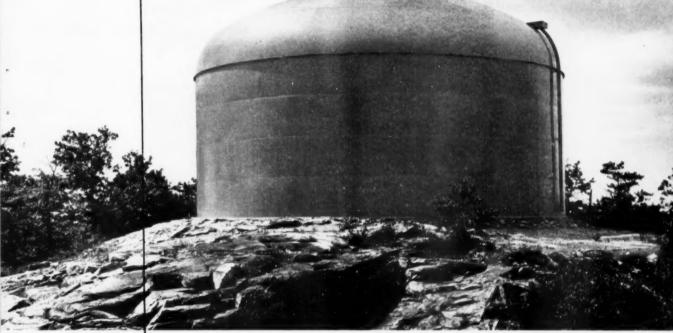


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LOW COST EFFICIENT WATER STORAGE

- at natural, elevations



Worcester, Mass. Ellipsoidal roof type, 1.500.000 gallons capacity.

* Steel Reservoirs



Liberty, N.Y.-Flat roof type, 300,000 gallons capacity



St. Paul, Minn. - Ellipsoidal roof type, 2,000,000 gallons capacity.

by PITTSBURGH · DES MOINES

The advantages of strength, simplicity, and economy of construction make Pittsburgh-Des Moines Steel Reservoirs your outstanding choice for water storage where elevated sites are available.

Durable for a lifetime, guaranteed in design, workmanship and material, P-DM Steel Reservoirs are built in flat-, dome-, or ellipsoidal-roof types, unornamented, or with pilasters and other architectural features as specified. Write for our latest descriptive Steel Reservoir Bulletin.



PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

PITTSBURGH (25) 3412 Naville Island NEWARK (2) . . . 215 Industrial Office Bldg, CHICAGO (3), 1216 First National Bank Bldg.

DES MOINES (8), 913 Tuttle Street DALLAS (1), 1217 Praetorian Bldg SEATTLE..... 520 Lane Street

SANTA CLARA, CAL..... ... 619 Alviso Road eners has already been treated by a municipal plant, regeneration service is less frequent.

"Municipal and Home Water Softening:" by T. E. Larson, Illinois State Water Survey. Journal, American Water Works Ass'n, June.

Sterilization by Ultraviolet Rays

In the 1940's a few small municipalities in the United States employed ultraviolet rays generated by mercury vapor lamps for sterilizing water, but because of their low penetrative power, these rays would not treat water at any great depth and their bactericidal efficiency was seriously lessened by traces of turbidity, color, or iron. Mercury vapor lamps, because of their high temperature, had to be separated from the water by a quartz tube, which sharply limited the effective penetration of the rays into the water. Elimination of part of these disadvantages has been made possible by the production of the "cold" lamp. Operated at the low temperature of 70° to 80° F., the new germicidal lamps can be operated submerged in water, and commercial equipment for utilizing them has been developed. To study the effect, on the results obtainable by such equipment, of turbidity, color, etc. in the water, the authors used a commercial sterilizer consisting of six 30-watt ultraviolet lamps placed in series in metal tubes highly polished on the inside. The water passes over the lamps in a special fashion, the depth of water over the tube being approximately 3/8 inch. When treating 750 gph, the water is exposed to ultraviolet rays for approximately 4.2 seconds. In conducting the tests, controlled suspension, color and iron were introduced into city water that had 0.1 ppm turbidity and 5.0 ppm color.

From the investigation it appeared that, using such a device, effective destruction of B. Coli can be anticipated when turbidity does not exceed 85 ppm, or iron exceed 3 ppm or inorganic color 90 ppm.; or, with turbidity of 15 ppm, iron does not exceed 5 ppm and inorganic color 150 ppm. (It was found that 30 ppm of organic turbidity has the same effect as 100 ppm of inorganic). If the water temperature is below 41° F. the output of the tube may be only 1/4 to 1/3 of its normal capacity, but this can be counter-balanced by operating the lamps at a higher wattage. The gradual deposition on the tubes of suspended matter from even clear water, makes it essential that the tubes can be kept clean to obtain maximum bactericidal efficiency.

"Application of Ultraviolet Ray Sterilization to Water Treatment;" by F. Wellington Gilcreas and Louis de Lalla, N. Y. State Dept. of Health. Journal, New England Water Works Ass'n., June.

Tannic Acid Prevents Corrosion of Pipe

The English Department of Scientific and Industrial Research has given some details of a discovery which, it is stated, may lead to a method of protecting underground water pipes, etc., from corrosion. Some iron implements 2,000 yr. old were excavated by the Ministry of Works on a site near York and were found to be perfectly preserved, though buried in one of the mostaggressive soils it is possible to find.

Because of the excellent state of their preservation, samples of the soil in which the implements had been buried were examined by the Chemical Research Laboratory. Sulphate-reducing bacteria were found to be present but not active, though the soil would normally have been highly aggressive against iron. It



P. O. Box 632 . . ELLWOOD CITY, PA.



was found that there were traces of tannate on one of the implements.

The soil on the site was peaty and contained many leather cuttings. Several mediaeval shoes were found and a number of knives which may have been used in the working of leather. It is believed that in the middle ages a cordwainers' hall stood nearby and that the area was the center of a leather industry. This was the obvious source of the tannin in the ground.

Cultures were made of sulphatereducing bacteria and inoculated with soil from the site. Their activity ceased if more than 5 percent was added, the result suggesting that extracts from the leather were at least partly responsible. Other experiments using solutions made from the leather itself confirmed this. Later work has shown that tannic acid in greater concentrations than 0.01 percent stops the action of sulphate-reducing bacteria. It is considered that this discovery may result in a method of protecting underground water and gas pipes from corrosion.

Highway Research Abstracts, June, 1953.

Industrial Wastes

(Continued from page 78)

Pulp Silo Drainage.-After sugar has been extracted from the beets. the remaining pulp is discharged to the pulp silo. There are about 300 tons of pulp for every 1000 tons of beets processed and the wet pulp that is discharged into the silo contains 92 to 93 percent moisture. A drainage system is provided to collect moisture that drains from the pulp. This is a very strong acid waste. Formerly, the pulp screen water waste and the pulp silo drainage wastes were discharged together to the main plant sewer. In 1951 the plant officials constructed a separate lagoon to hold pulp silo drainage wastes. A very good growing season in 1951 resulted in a near-record beet harvest, with the result that there was a greater volume of this particular type of waste than had been anticipated. Consequently, the pulp silo drainage lagoon was not of sufficient size to contain all of the wastes produced. In 1952 the dikes surrounding this lagoon were raised and the lagoon contained all pulp silo drainage wastes during the 1952 campaign. The lagoon area is now



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81/2 acres, the average water depth about four feet.

SUMMARY.—The South Dakota Department of Health has been following the improvements at the sugar beet company's plant quite closely and have been carrying out laboratory studies each year. In 1950 the combined wastes 5-day BOD as discharged into Belle Fourche River averaged 575 ppm with a population equivalent of approximately 190,000. In 1952, with the construction of the lagoon to hold the pulp silo drainage wastes, the combined strength of the wastes

discharged to the Belle Fourche River was 180 ppm or a population equivalent of approximately 59.500 It is recognized that there is still room for improvement, but the plant has spent approximately \$10,000 on these changes in the last two years and decreased wastes discharged to the Belle Fourche River approximately 70%. With a record beet production the last two years and the development of new potential beet producing areas in South Dakota. the plant officials and the South Dakota Department of Health have reached tentative agreements on ad-

ditional long range plans to further decrease industrial sugar beet wastes that are currently being discharged to the Belle Fourche River.

Cheese Factory

Milbank, South Dakota, located in the northwestern part of the state. started considering a new sewage treatment plant in 1945; plans and specifications were approved in July, 1948; and the project was contracted in February, 1949, for \$143,-000. The plant was designed on the basis of flow and sewage strengths determined by field studies in the summer of 1945. In July, 1950, the State Department of Health was advised by both the consulting engineer and the City that trouble was being experienced in the plant and an investigation indicated that there was septicity in both the primary and secondary plant units. There were several possible reasons for this, including plant operation; however, it was felt that industry in this town of about 3,000 people was contributing to the difficulty.

An industrial waste survey was made in February, 1951, a winter study in contrast to the pre-plant design studies made in the summer of 1945. The industries concerned were a sausage company, a produce company, and a cheese plant. It was found that the sausage company and produce company were not contributing materially to the problem. The cheese plant, which had been disposing of whey to the farmers during the summer survey in 1945, was now discharging whey direct to the sewers. After determining that whey was being discharged to the sewers, a laboratory survey was made in May, 1951, and at that time a 24-hour composite sample of the raw sewage had a BOD of 1200 ppm compared to 400 ppm in the summer of 1945. A 12-hour composite sample of raw sewage in May, 1951, had a strength of 1700 ppm. A conference between the cheese plant officials, the City and the State Department of Health resulted in a recommendation to the cheese plant that whey be removed from the sewers by July, 1951. The cheese factory officials were very cooperative and installed a Buflovak Roller drier with a capacity of 3000 to 5000 lbs. per hour. All of the whey from the cheese processing operations is dried in this piece of equipment, the moisture is discharged to the atmosphere, and the dried material is sold to another



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Another field investigation was made by the State Department of Health in October and November. 1951, and at this time the BOD of the raw sewage varied from 350 to 380 ppm.

Since whey has been removed from the sewers, plant operation has become much more simplified, the plant is discharging a reasonably satisfactory effluent, and the cheese factory is quite well pleased with the installation of their drier.

Creamery Company

During the first part of 1950. Bristol, South Dakota, initiated planning for a sewage treatment plant. One of the principal sources of waste was the Sugar Creek Creamery. Consultations between the City and its consulting engineer, the Sugar Creek Creamery and their consultants, and the South Dakota Department of Health resulted in a plan for one sewage treatment plant to handle all waste.

The plant was designed for a population of 800, while the 1950 Bristol population was 647. The designated domestic BOD loading was 136 lbs. per day; the designed creamery BOD loading was 68 lbs. per day with a total flow not to exceed 5000 gallons per day. The plant consists of a lift station, Imhoff tank, trickling filter, final settling tank, and sludge drying bed with effluent discharge to one of a series of lakes in the James River.

The Imhoff tank was designed with an overflow rating of 540 gallons per square foot per day, a detention period of two hours, and a sludge storage volume of 5 cu. ft. per capita. No BOD reduction of the milk waste is assumed through the Imhoff tank and in lieu thereof is considered as a direct loading on the filter. Recirculation of secondary sludge is practiced to maintain a constant two-hour detention in the Imhoff tank.

The trickling filter, 40 ft. diameter by 8 ft. deep, has a hydraulic loading of 3.7 mgad with an estimated BOD loading of 390 lbs. per acre foot. An additional winter safeguard in the form of a wind breaker wall was installed around the periphery of the filter as an aid in the prevention of freezing during winter operation.

The final settling tank, rectangular in plan, has a hopper bottom and an overflow rate of 160 gallons per square foot per day. The detention period in this unit is two hours.

This particular plant is the only installation in South Dakota where milk processing wastes mixed with domestic sewage are being routed through an Imhoff tank in such a manner as to maintain a continuous two-hour detention. This practice was incorporated in this particular design as it seemed to be more economical than a separate holding tank and milk waste line to the filter.

In an effort to carry out their part of the bargain for restricting both strength and volume of creamery wastes, the creamery has installed the necessary units for conversion from a vacuum pan to a roller drier for butter milk handling. This conversion has been to the creamery's advantage as a portion of the municipal sewage treatment plant operating costs are charged to the creamery with an elevation in such charges if they exceed the strength and quantity limits as set forth in the original agreement.



PUBLIC

WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Night Work in Repaying an Expressway

New York's Long Island State Park Com'n, has for two years been modernizing a 25-yr. old parkway that carries 60,000 vehicles a day, with 3,500 cars an hour moving in one direction during peak commuter traffic. During 1952 the contractor widened the existing concrete slab by 31/2 ft. and widened cuts and fills to permit shoulder construction. This was followed by repaving according to a fixed schedule without seriously disrupting traffic. Each morning at 9, after the height of commuter traffic to New York, the roadway for this traffic was closed and the remaining traffic was diverted to parallel roads, and paving begun and continued until 4 P.M. when the roadway was opened to the evening rush from the city. At 8:30 P.M. patrolmen began diverting traffic to parallel roads. At 9 P.M. work started and continued until 6 the next morning, when the newly surfaced lanes were opened to traffic again. Overtime was paid from 9 P.M. to midnight. In addition to stationary lights, extra lamps were mounted on the equipment. The daylight crew laid about 500 tons of asphalt during its 61/2-hr. schedule, and the night crew laid 900 to 1,000 tons during its 81/2 hr. shift. The new surface consists of a 11/2-in, binder course and a 1-in. top course.

"Night Work Speeds Repaving, Avoids Heavy Traffic Tieups: Engineering News-Record, July 2.

Hot Plant Mix Is Economical

Jefferson Co., Wis., has 385 miles of county roads, about half of which are paved with plant mix laid with a finisher; the other half with road mix, which are gradually being resurfaced with plant mix. The cost per mile of roads paved with finisher, using hot plant mix, ranges from \$2900 to \$3600, varying chiefly with the length of haul. Jobs of comparable size using blade mixing cost from \$3300 to \$3700 per mile. Where paving over a gravel road, the road is lightly bladed to grade. the surface swept, and a prime coat applied to the outer four feet on each side of the road (and there only) to prevent edge raveling. On this is placed a 2" mat, using 34" max. aggregate. When resurfacing existing black-top, the general procedure is the same. The 18 to 20-ft. roads are widened to 24 ft. All plant mix payements are seal coated, and the seal coat renewed every five years. The equipment used is a Barber-Greene mixer, dryer and portable conveyor; a Cleaver-Brooks boiler; fuel oil and asphalt tank trailers; 3/4-yd. shovel; 8-12 ton roller; front-end broom on wheel tractor; a Rosco distributor, and 10 or more trucks. This year they are adding a dust collector to minimize dust in the plant vicinity. and to cut down on the maintenance of engines, bearings, etc. More important, the dust collector conserves fines in the aggregate—as much as \$1700 worth in one year.

"Hot Plant Mix Is Economical for County Highways;" by P. S. Banaszek, H'way Com'r. PUBLIC WORKS, July.

Effect of High Temperature on Aggregates

In the process of drying and mixing aggregates, they may be exposed to temperatures which, in a poorly designed or operated dryer, may locally reach quite high values. Some aggregates may be so affected by these temperatures that they fail to retain the strength shown by laboratory tests. This possibility was studied by the English Road Research Laboratory. Eleven different aggregates with crushing strengths

ranging from 13 to 29 were subjected to temperatures of 105° C, 250° and 500° for 15 min. and 1,000° for 2 min., and tested by crushing and impact at each of these. The results showed that aggregates differ from each other considerably in the extent to which they are affected by high temperatures; all the aggregates were weakened by heating to 500° C for 15 min., and considerably weakened by 2 min. at 1,000°. However, quartz-dolerite became about 25% stronger after being heated for two days at 105° C. But, except in a few cases, the effects are not of practical significance with the temperatures likely to be experienced in practice.

"The Effect of High Temperatures on the Strength of Roadmaking Aggregates:" by F. A. Shergold, Roads and Road Construction (England),

Selection and Upkeep of Signs

The base metal of roadway signs should be a mild steel of suitable composition and hardness, with a zinc coat of not less than 11/8 oz. per sq. ft. (including both sides) processed for painting. The gauge is usually 18 for signs of less than 4 sq. ft.; 16-gauge for 4 sq. ft. or larger. Except for vandalism or accidents, signs with a finish of vitreous enamel have a probable life of 15 to 20 yr., and a higher price; those with ovenbaked enamel, 5 to 10 yr.; with a finish of air-dry enamel, the cost is least but the probable life is only 1 to 5 yr.

Most discoloration of signs is caused by muddy water splashed by passing vehicles. Washing signs is a costly maintenance problem. Missouri sign fieldmen mix sodium bicarbonate with a sodium hypochlorite solution for cleaning. When a sign needs to be refinished, sand blasting sometimes is used to remove

right grader for the job

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M. L. McClay, Supt. of Streets, Iola, Kansas



In any fast-growing community there's a constant demand for grading, resurfacing, cleaning up and general road maintenance. Iola, Kansas, is such a town. The street department compared the work of other motor graders and chose the Cat* No. 212. What they found by practical demonstration was that this 50-HP machine had the power and work capacity to give them everything they needed.

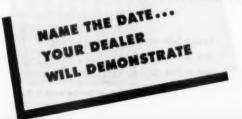
Whether you pick the No. 12, 112 or 212, your Caterpillar Motor Grader is a balanced machine. Weight, power and working speed are matched for maximum work output. Blade positions can be controlled from the driver's seat, going through the full range of positions in less than a minute. And the operator can always see what he's doing.

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the old paint but it removes much of the zinc, also, and use of a liquid paint remover is better. Reasonable freedom from splashing can be secured by placing the sign 4 ft. from the edge of the pavement if it is 5.45 ft. above the pavement, to 10 ft. from the edge of the pavement if only 2.95 ft. above the pavement to the bottom of the sign. Instead or steel, aluminum is a very satisfactory material, but more expensive. Sheet fiberglass seems to be a very promising material, also.

"Many Considerations Involved in Sign Selection and Upkeep;" by

Leon W. Corder, Traffic Engineer, Missouri State H'way Dept, Better Roads, June.

Sawing Weakened-Plane Joints

Since 1952, California Div. of Highways has sawed nearly 260,000 lin, ft. of weakened plane joints in concrete pavements on five paving projects. So far this procedure is considered largely experimental. However, these joints appear to be superior to the premolded paper strip type used in the past, but more expensive. The advantages are that the sawed joint insures a groove that is vertical and straight, surrounded by a concrete that is of a quality equal to the rest of the pavement. There is less spalling at the joints. The narrow groove is not noticeable at average driving speeds. The sawed joint permits a better sequence of operations of the finishing equipment train.

Cracking tends to take place in freshly placed concrete slabs while drying and during hardening of the cement paste. This causes transverse random cracks at intervals of 60 to 90 ft. To be effective in preventing these, sawed weakened plant joints must be made before the concrete has completed this contracting. On the other hand, if they are made before the concrete has hardened sufficiently, sawing is apt to tear the concrete. The proper time seems to vary from 7 hr. on a hot day to 26 hr. in cool, foggy weather. One of the major sources of early shrinkage is the loss of excess mixing water, and delaying this loss delays tensile stresses in the concrete and the resulting shrinkage cracks. Continued heavy fogging of the fresh concrete until the final curing operation gets under way helps.

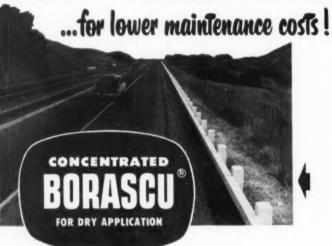
At first the cuts were made 2" deep; but 11/2" depth in a few test sections seemed to be equally effective and will be specified in future contracts to reduce the cost by 10 to 15%. The cost of sawing joints is approximately 27¢ per lineal foot of joint, 5¢ for labor, 5¢ for equipment, and 17¢ for the blades. The blades cost \$130 for 10" diameter and \$150 for the 12". Blades wear faster when cutting green concrete than when cutting hardened; and when cutting concrete with an aggregate of a basaltic nature than with one of limestone. The blade is kept cool and lubricated with water spray; inadequate water supply will lower blade footage and even ruin the blade. The ordinary hand-guided concrete saw can be used; but a multiple-bladed saw has been developed especially for this purpose, which is mechanically propelled.

"Sawing Weakened Plane Contraction Joints in Pavement;" by D. G. Evans, Construction Engr., California Div. of Highways. California Highways and Public Works, June.

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266 North 25th St. Milwaukee 3, Wisc. equipment manufacturers and distributors and a salt manufacturer applied it to 2½ miles of old gravel light-traffic road near Elgin, Ill. First, a 2-in. course of pit-run gravel was added and the road scarified 4" deep, bladed to proper crown and sprinkled to give optimum moisture content. Next a rotary mixerblender mixed gravel and fines to a depth of 4" and salt was applied at a rate of 4 tons per mile by a truck-mounted hydraulic spreader. Then the salt and 4" of gravel were blended with a rotary mixer. The

road was then rolled with an 8-wheel pneumatic-tired roller, water being applied meantime and rolling continued until all excess surface water was dispersed and the road compacted to a smooth surface. Claims for this process were that the brine solution lubricates the gravel and improves its workability, so that it can be compacted to a high degree of density and water tightness.

"Stabilizing a Township Road With Salt:" Engineering News-Record, June 25.



Opinions of as many highway officials as could be located who had tried rubber in asphalt paving all agreed that there had been no detrimental effect, and that a longer period of testing in actual service is necessary for forming final opinions. In Virginia and District of Columbia, the rubberized surfaces show a slightly greater skid resistance. In Massachusetts, addition of 5 to 7½% of rubber decreased cracking of bituminous concrete and increased bond of asphalt to aggregate.

"Rubber in Pavements—A Progress Report;" PUBLIC WORKS,

July.



(Continued from page 93)

Temperature and smoke recording equipment may be invaluable as complaints can be evaluated. Without records and evidence, there is no way of refuting complaints. Preventive maintenance and good record keeping will materially reduce maintenance costs.

A well-kept incinerator can be a better neighbor than the average manufacturing plant. For that matter, many large hotels, located in the centers of cities, operate incinerator plants large enough to serve a small community. The furnace is inside the building and the chimney extends through the roof. Though wet mixtures from the restaurants in the hotel are burned, there is no nuisance; and if a hotel incinerator can be operated without nuisance, a municipal incinerator can do even better.

An incinerator should be rated on its hourly capacity, though custom has rated them on a 24-hour basis. Factors of location, type of architecture and mechanical equipment required makes it difficult to give a unit price applicable to all conditions. For a small installation, the cost per ton will be higher than for a large one. On the basis of 24-hour canacity, a community of 5000 population may spend \$50,000 to \$60,-000 for a building and plant of about 20 tons capacity. A community of 10,000 may get a 30 to 40-ton plant for something under \$80,000. A city of 30,000 will require a 100-ton plant which may cost around \$150,-000. That is, the cost per ton of 24hour capacity may range from \$1500 to \$3000, depending on the size.



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In Ohio, it is possible to finance an incinerator by means of mortgage revenue bonds which do not obligate the municipality's general bonding power under the five percent limitation. The plant is then operated as a business, with its own set of books, with proper cost allocations to maintenance, depreciation, replacement and additions. Through a system of service charges, each householder pays in direct proportion to the service he receives. General obligation bonds may also, of course, be utilized.

This article is based on a paper presented by Col. Stilson at the March, 1953, meeting of the Ohio Society of Professional Engineers.

Seeding New Slopes on Highways

Getting grass seed to grow on new slopes has been a problem for the highway engineer. One answer is chemical conditioning to hold the soil and the seed against beating rain and scouring runoff. The job is to get the conditioner, seed, fertilizer and water distributed quickly and economically. Some road builders already have equipment that will do this job, big truck-borne rigs for spraying a mixture of grass seed. fertilizer and water on large areas of raw earth. Monsanto worked with the Connecticut State Highway Department to learn how these rigs could spray Bondite, trade name for Monsanto soil conditioners for erosion control, as well as seed, fertilizer and water in a single opera-

The outfit Monsanto and Connecticut settled on includes a 500-1000 gallon tank containing an agitator for mixing Bondite into the water. seed and fertilizer. A 25-horsepower pump sprays this slurry 65 to 100 feet from a moving truck, covering an acre in 30 to 40 minutes.

Desalting Water by Ionselective-type Membranes

For changing salt water into fresh selective-type membranes, used in one process, have been vastly improved. These membranes are made of ion-exchange resins, which with the use of a direct current of electricity, will permit ions of only a certain charge to pass through. Ions of opposite charge are repelled.

In operation, the raw water flows into an enclosed unit consisting of cells made up of these selective membranes. The end cells are provided with terminals for connection to the electrical currents. As the water and current pass through the unit, the liquid in alternate cells loses its salt content and becomes potable. The liquid in the remaining cells picks up this salt and becomes saltier than the original raw water. By increasing the electrical current, or the physical size of these cells, the rate of desalting can be increased. The effluent from the unit consists of two sections. One portion is the desalted potable water. the other portion is the water with the increased salt content. The usual ratio of these portions is about 2 to 1, respectively. In some cases, getting rid of the later portion may present a problem.

At present, there are two membrane manufacturers. Both have small laboratory models of desalting units in operation. The Bureau of Yards and Docks is watching closely the advances in this field and expects, in the near future, to place a development contract for a unit having an output of about 40 gallons per hour of potable water. (Navy BuDocks Technical Digest)





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DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Sewer Connection Charges in California

Few California cities make any charge to citizens for connecting their properties to the sewer. Such charges, where made, are generally computed by the front foot or square foot, or a lump sum charged. Charges per front foot vary from 75¢ to \$3.00. One city charges \$533 per acre for subdivisible property or industrial sites. The lump sum charges range from \$35 to \$150 per connection.

"Sewer Connection Charges Made on Area, Footage and Lump Sum Basis:" Western City, June.

Operation of **Oxidation Ponds**

In most secondary treatment processed, oxygen from the atmosphere is forced to enter the liquid phase at an accelerated rate. In oxidation ponds, effort is made to use photosynthetic oxygenation to supplement natural reaeration. This may be defined as the production of oxygen through the action of light on the chloroplastic tissue of microscopic green plants, growing dispersed in the aqueous medium, the oxygen being derived from the decomposition of the water by photosynthesis. Bodies of water containing green algae may thus attain supersaturation with dissolved oxygen up to three or four times the normal. When sewage enters an oxidation pond or lagoon, bacteria decompose it, carbon dioxide and ammonia are produced, and oxygen is consumed at a rapid rate, which may cause oxygen depletion. In about ten days. when light and temperature are satisfactory, algal populations appear in significant numbers and synthetic oxygenation occurs, and available nitrogen is synthesized into cell protein. Wind currents and wave action tend to promote some mixing of the bacterial and algal phases. Ideal pond treatment would involve an overlapping of the two phases, so that the oxygen could be provided when and where needed by the bacteria. These operations are affected by light and temperature; a period of intensive light followed by a dark period is beneficial if not vital to increasing the overall rate of photosynthesis. Variations in temperature appear to be principally important in their influence on rate of cell growth subsequent to initial photosynthesis and hence upon total cell yield. Algae are ecologically versatile, able to adapt themselves to changing conditions. But if the environment of oxidation ponds can be controlled to minimize unfavorable conditions, their efficiency should be greatly improved.

"Algae Symbiosis in Oxidation Ponds;" by Wm. J. Oswald, research engr., Univ. of Calif., et al. Sewage and Industrial Wastes, June.

Odors from Imhoff Tanks

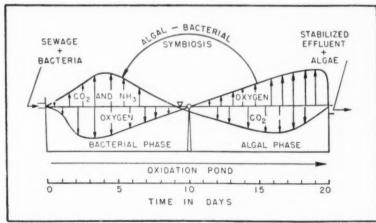
Excessive odors from Imhoff tanks most commonly result from septic sewage reaching the tank. This may be caused by sags in the sewer line; undesirably large wet wells in the pumping stations; very long sewer systems; dry weather, causing decrease in volume of flow and therefore in velocity; excessive detention time in the Imhoff tank; drawing off incompletely digested sludge. Remedies include chlorination of sewage in the sewers themselves; or, where this is impracticable, in the plant wet well. Instead of chlorine, ferrous and ferric chloride is sometimes more economical. "Chloroben" has been used with considerable success in up-sewer treatment.

"Control of Odors and Filter Flies:" by A. B. Ritter, Chief, Section of Insect Vector Control, Louisiana Dept. of Health. Proceedings, 15th Annual Short Course,

Louisiana State Univ.

Review of 1952 Literature

This review of 149 articles and reports dealing with the treatment of industrial wastes and 250 dealing with water pollution occupies 50 pages of the Journal of the Federation of Sewage and Industrial Wastes Associations, prepared by its Committee on Research. A brief summary of each article is given,



Courtesy Sewage & Industrial Wastes

SCHEMATIC representation of action in oxidation ponds.



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Here's The Payoff

ORANGEBURG, S. C.-Grab samples taken during midsummer of 1952 showed raw sewage BOD to average 313 ppm and the final effluent to average 86 ppm, with BOD removals averaging 72.6 percent. These data are through the courtesy of James H. Stephens, Chief Sanitary Engineer of the State Board of Health.



W. S. Dickey Clay Mfg. Co., Ayer-McCarel Clay Co., Inc. Kansas City 6, Mo., Brazil, Ind

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the matter relating to industrial wastes being divided into sections dealing respectively with cannery, dairy, beet sugar, chemical and pharmaceutical, fermentation, packinghouse, textile, tanning, wool scouring, brines, oil refinery, coking, plating, pickling, pulp and paper wastes. The articles reviewed include a number from English literature and two from French.

Sections under the head of "Water Pollution" deal with chemistry, bacteriology, biology, BOD and oxygen sag, stream surveys and studies, abatement and control. The 250 items under this head include a considerable number from foreign sources, including England, Germany, France, Russia, Switzerland, Argentina, Poland, etc.

The review ends with a general summary and statements of significant trends. Among the latter, it is noted that "In general, industrial waste creatment is going through a period of intensive basic and applied research for the development of new methods of creatment and firmer establishment and application of old methods."

"A Critical Review of the Literature of 1952 on Sewage, Waste Treatment, and Water Pollution"; by The Committee on Research, Federation of Sewage and Industrial Wastes Associations. Sewage and Industrial Wastes, June.

"Complete" Treatment At the Cost of Primary

The author believes that, by a change in the theoretical approach to the problem, it is possible to construct complete treatment plants for the cost of primary treatment. In most plants, the money spent for treatment of the solids, which constitute a very small part of the sewage, is disproportionately large. It can be decreased, in the case of large plants, by vacuum filtration with a sludge storage tank, as at Pittsburgh. For small plants, adding anhydrous ferric chloride and dewatering on sand beds for six hours give a forkable cake, nearly odorless and sterile.

For secondary treatment, the plant recommended is a primary settling tank designed for only 15 min. detention at maximum flow. Or, as a substitute, a self-cleaning fine screen. Either of these will remove such solids as would tend to clog a filter. Then the filter will have a heavy lead of suspended material to treat. For this there is recommended a filtering medium of prefabricated tile and rain-like dis-

tribution, with a bed area of 200 sq. ft. per 1.000 population. The final settling tank is based upon a design of 1200 gallons per sq. ft. overflow rate, such as a Spiraflow tank.

"Waste Treatment Methods and Economies;" by Randolph L. Smith and Robert J. Ellison, *PUBLIC* WORKS, July.

Cost of Municipal Refuse Incineration

Alhambra, Calif., incinerates its refuse except the garbage, which is collected separately and fed to hogs. The amount incinerated in the fiscal year 1951-1952 was 9,029 tons, using a Nichols Monohearth with a rated capacity of 150 tons in 24 hr. An 8-hr. shift 5 days a week handles an average of 37 tons a burning day or 6.25 tons an hour—the rated capacity. Three men are employed, and the labor for plant operation cost \$7,674; for ash removal, \$1,932; for plant maintenance, \$615; for plant repair, \$204. Maintenance of grounds and scale house, supervision, insurance and other items brought the total cost to \$22,519.

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combustible waste materials pay a disposal fee of 25¢ for 100 lb. or less; 35¢ for 101 to 200 lb.; 45¢ for 201 to 300 lb., and 15¢ per 100 lb. for all over 300 lb. The total revenue for the 1951-1952 year was \$6,814, leaving the net cost of incineration \$15,-705.

"Costs of Municipal Refuse Incineration;" by W. M. Jarrett, City Engr. and Street Supt. *PUBLIC* WORKS, July.

Control of Digester Scum

Scum at the top of digesters causes loss of capacity, increased cost of operation, and may prevent normal overflow. In many plants it is a mass of ground screenings, grease, and raw sludge. It is very difficult to provide the intimate contact of bacteria with this material which is necessary for digestion. Also the material is not in the condition most favorable for rapid digestion. Bar screenings that have been ground or cut up never approach the minute size of normal organic solids macerated by long travel in sewers. Grease alone digests readily, but a mixture of grease and ground screenings requires twice as long. Materials like rags, hair, straw and small pieces of wood never digest in a normal cycle. Paper towels digest slowly. At the Ley Creek (Syracuse, N. Y.) plant, properly seeded activated sludge digested at 70° F in 30 days, but replacements of 10% and 20% of the sludge volume by screenings increased the digestion period to 35 and 40 days, respectively.

Due to the difficulty of creating the proper conditions for digesting screenings and grease, no screenings or skimmings from the primary tanks have been pumped to the digesters at the Ley Creek plant, and the scum on the digesters is only about a foot thick, soft and pliable. Instead, screenings and skimmings are burned in an incinerator with a capacity of 1,000 lb. per hr. of screenings with 90% moisture. During 1952, 13.188 cu. ft. of screenings and skimmings was burned at a cost of \$965.77 for fuel oil. The incinerator cost \$14,000 and its use saved digester capacity valued at many thousands in addition to providing simpler and more efficient operation.

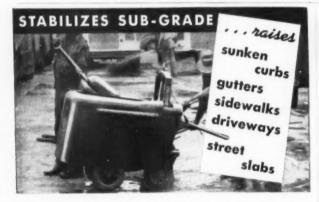
"Digester Scum Control at Syracuse, N. Y." by Uhl T. Mann, Supt. Ley Creek Plant. Sewage and Industrial Wastes, June.

Collecting Rubbish by Packers Costs Less

In 1952 the City of Newton, Mass., collected 30,309.77 tons of rubbish at an average cost of \$7.29 a ton. This was \$0.56 a ton less than the cost in 1951. Said Willard S. Pratt, Director of Public Works, in his annual report, this "indicates that the addition of the packer units in 1951, and the two additional that were purchased in 1952 makes for a more economical and efficient operation."

Tractor-Digger-Loader Does Many Water Works Jobs

A Ford tractor equipped with a Sherman digger and a Sherman loader is reported as the most useful equipment by Ivan V. Fosheim, Sup't., Department of Water Supply of Pontiac, Mich. This machine is used to dig for taps, hydrants and short main jobs; to load excavated material and do cleanup work; and in the pipe storage yard for handling materials. Often, it is loaned to other city departments. Pontiac has purchased a well-drilling machine and is working with hydrogeologists in searching for additional water supply.

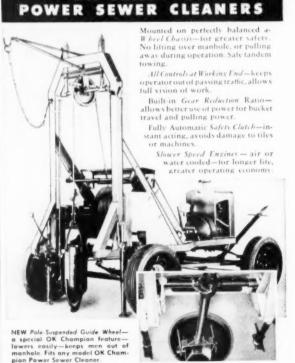


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raised sunken slabs at city bus terminal (above) . . . stabilized sub-grade support under the paved parking area without interrupting traffic. Small holes were drilled through the pavement . . . then, Mud-Jack pumped inexpensive soil-cement slurry into the holes, raised the concrete,

leaving solid, permanent support. Compact, portable as a 2-wheel cart, this No. 10 Mud-Jack is ideal for city work... no inconvenience to the public, no detours necessary. Also check the bigger No. 50 Mud-Jack for preventive maintenance and repairs on extensive highway work. Saves time, money and labor.





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Lighting and Traffic Control

Keeping Traffic Moving During Construction

ERVIN R. LEISER.

Asst. Traffic Control Engineer, Milwaukee, Wisc.

GOOD public relations are most important in any phase of traffic engineering, but they are particularly important to the successful completion of an improvement during the course of which the upsetting of normal traffic patterns is required. With careful thought and planning, the job can be carried out in such a manner as to invite public cooperation instead of earning public criticism.

Techniques, methods and requirements for the temporary rerouting of urban traffic obviously vary from those suitable for rural traffic. Distances; mass transit operation; vehicular and pedestrian volumes; commercial requirements; parking facilities: turning movements: intersecting traffic; availability of alternate routes; pavement conditions; lane capacity and distractions-all of these factors, and others also, dictate the need for careful planning and coordination of construction activities to the end that any particular construction project may be completed with the least possible interference with, or inconvenience to, the normal course of modern living.

Everyone working on a project is fully acquainted with all of the construction details. The planners, the sponsoring agency, the engineers, the contractors, and, in some instances, abutting property owners, know when work is to start, how much time will be required for completion, what operations need to be performed, and what the improvement will look like when finished. Too often, however the general public normally using the street to be temporarily shut down is left completely in the dark. Just how such dislocated traffic is to be routed is left to chance.

The result is that some morning Mr. Citizen, taking his customary route to his work or business, is confronted with a series of barricades and maybe a sign reading "STREET CLOSED" with no advance warning. Such a sign, all by itself, has about the same effect as saying, "NUTS TO YOU BROTHER

—FIGURE IT OUT FOR YOUR-SELF." Then Mr. Citizen, along with many other citizens, tries to do just that. The result is confusion, frayed tempers and, in fact, a general mess.

If traffic demand indicates the need for rebuilding an existing roadway or the building of a new roadway, then certainly it follows that such traffic is sufficiently important in volume to warrant adequate preparations for temporarily shunting it to properly protected alternate routes. Any effort that results in reducing confusion, congestion, and delays to a minimum will be more than compensated for in the satisfaction of accomplishing major improvements without disrupting the public's activities any more than absolutely necessary.

The Engineer's Job

The traffic engineer is the logical person to initiate action and to promote coordination and cooperation among the sponsoring agency, contractor, enforcement department, transit operators, and engineering interests. Pertinent elements of the

plan agreed to may then properly be incorporated in the paving contract, and the sponsoring agency's inspector should be responsible for performing the work in accordance with contract provisions. The general public should, of course, be informed as to how normal traffic will be affected; and the most satisfactory methods of accomplishing this are through the use of large and conspicuous information signs and notices in the daily press. One factor in particular should be emphasized: the designation of the street closing and reopening dates. Such dates should be scheduled to provide a reasonable opportunity for the preparation of alternate routes and establishment of temporary traffic

The best possible temporary traffic pattern can be agreed to only after taking into account all of the following factors:

1. Type of traffic normally using the street. Does it include mass transit traffic with its special considerations, and trucking? Does it carry a State or Federal Highway? If transit vehicles and trucking are included, then certainly 12 ft. of roadway space must be provided for each lane.

2. Service access to commercial establishments involving hauling of supplies and finished products. Businesses cannot be expected to close their doors because the street is being paved.

(Continued on next page)

Street Lighting System for Levittown Is Modern

ALL street lighting in Levittown, Pa., will be controlled automatically by photo-electric cells to



provide light at sundown and to turn the lights off at sunrise. All wiring is underground and cables are water and corrosion proof, buried two feet down along the front lot lines between the curb and sidewalk. More than 4,000 light standards will be required for the completed system. These will be aluminum, 20 ft. high, with 4-ft. tapered elliptical brackets. Poles will weigh only 100 lbs. each; they will be spaced 210 ft. apart, on one side of the street, and anchored four feet deep in concrete. These posts will be furnished by Pfaff & Kendall.

The system of street lighting will provide a minimum of 0.1 footcandle for all paved areas, with extra intensities of 0.2 and 0.3 fc at intersections and circumferential roads. Lamps will be of 100 and 200 candlepower. Anti-glare reflectors will direct the light to the street surfaces with minimum reflection into windows of homes.

3. How much traffic normally uses the street and must be superimposed on the traffic normally using other streets under consideration as alternate routes? What parking will need to be dispensed with in order to accommodate the combined traffic load?

4. What major traffic carriers will be intersected, and what traffic controls will be required? Will a police officer be required, or will traffic control signals be necessary?

5. What are the pedestrian needs, particularly those of school children? Will they require special protection such as a police officer or a school crossing guard?

6. Will special pavement markings be needed, that is, center lines, lane lines and crosswalk lines?

7. Will the existing pavement condition on the detour or alternate route carry the extra traffic load or will it require advance preparation and interim treatment?

8. If public safety and health institutions (fire houses, hospitals, etc.) or commercial and industrial establishments front on the temporary route, will their operations be interfered with sufficiently so as to require special attention?

After all of these have been considered and a temporary route has been selected, there remains the job of fabricating and installing the necessary traffic controls, information, and directional signs.

We proceed on the premise that whatever traffic can be diverted from the construction zone proper is just that much gained, and so we consider carefully the locations at which information signs should be posted. If drivers are warned of travel obstructions ahead, they may use another route to bypass the construction area. At strategic locations, we post signs stating that such and such a street is under construction between specific points, and suggest using other routes. In some cases we post such diverting signs in an area of several miles radius, and expressions of appreciation are frequently heard.

Traffic continuing along its normal route receives repeated warnings at appropriate diverting points, as does merging traffic at intermediate locations, until the construction area has been reached. The result is that, finally, not much more than the traffic having business in the area is affected by paving operations.

In spite of the most carefully laid plans, it is sometimes necessary to reroute traffic on very short notice because of unforeseen developments. We, therefore, developed a traffic signing technique to simplify the job; and it has been responsible for saving a great deal of time.

Special Signs

Our special signs are made of several component parts. First, a sign backboard of 34-in. plywood, 4 ft. square. These sign backboards are readily fastened to pipe standards, utility poles and sign easels, and in some cases are even placed on trees. Second, the sign message is made up of 3/8-inch plywood panels, 10 ins. wide, and 32, 38, or 48 ins. in length, depending on the length of the words used. These panels are lettered in advance; and a stock of commonly used words is kept on hand. Sign panels with words such STREET, DETOUR, CON-LEFT, RIGHT. STRUCTION. CLOSED, etc., are used over and over again during each construction season. These sign panels are tacked to the sign backboard.

The advantage of this method is that when a temporary traffic route to be placed in use requires a large number of signs, all of the sign backboards may be installed in advance and the sign message added at the proper time. In one case where more than thirty special signs were required over a considerable area and when all sign backboards were installed previously, the entire detour layout was placed in effect in about one hour. At the close of a paving season, all signs and sign panels are cleaned and/or repainted as may be required so that all of the material will be ready for the next season and in uniform condition. Sign panels bearing street names not expected to be used again for some time are painted white and made ready for the next mes-

One other matter in the rerouting of traffic needs to be kept in mind. It must be remembered that when drivers accustomed to everyday routes and traffic regulations are suddenly rerouted, it is important to provide plenty of large and conspicuous signs. For instance, where 24-inch "STOP" signs are normally sufficient in size, it may be necessary to use 30-inch signs along a detour traveled by many persons not familiar with the route.

The cost of adequate rerouting is well justified. Either way, the public pays the bill. And who is the public? Are we not all a part of it, and are we not all happy to spend a little money if it will be returned to us many times over? That is just human nature. Making such savings

possible by spending a small fraction of the total for adequate rerouting purposes cannot reasonably be classified as extravagance.

This article is based on a portion of a discussion by Mr. Leiser at the Traffic Engineering Institute of the University of Wisconsin.

Portland Pipeline

(Continued from page 81)

is geared to growing fir forests, and everything else gropes through the "mist." So when January became a show-off month, with 14.67 inches of rain—the third highest in any month on record—everything floated except the hills, and some of them slid down. All construction stopped. Six sections of pipe, bulkheaded for tests and partially backfilled, floated to the surface.

Trenching sounds easy, with the best equipment and long experience, but it is not easy to cut the walls straight down, as required in the specifications, so a good deal more dirt came out than was expected. More pavement was destroyed, and more pavement and dirt must be put back. Even so, from 200 to 300 ft. of trench was cut every 8-hour shift, and sometimes two and three shifts have been required to keep ahead of the steel.

The Work Program

The steel is kept two days ahead of pipe assemblies, and assemblies are kept two days ahead of the couplings. The final wrapping and exterior treatment follow quickly, and then the field test is conducted. Backfilling has to be done immediately to restore roadways and streets to use.

Field testing is fully as rigorous as the shop tests, and complements them perfectly. After the pipe has been laid, painted, and backfilled between bell holes, it is plugged in sections generally 2500 ft. long, and given a hydrostatic test. The pressure must be at least 50 lbs. in excess of the maximum operating pressure, but never less than 125 nor more than 230 psi. Water for testing is supplied by the city, free, the contractor making the necessary connections. Non-potable water may not be used.

In actual operation a long line of pipe may have to be filled to the test section, and after the test the water must be pumped out. Before the test all bell holes must be cleaned out and pumped dry, so that careful inspection can be made of each joint. If any leakage develops, it must be repaired immediately. The closing of pipe ends and all openings must be absolutely tight to prevent filling the trench with water.

The couplings are Style 38 Dresser. They have 7/16-in. T-bar type followers, middle rings, and wedge type gaskets #27. They are pulled tight with 36 steel track head bolts on 66-in. pipe, and 32 bolts on 56-in. pipe. The couplings are sand blasted and primed at the factory. After installation a coupler compound is poured into catch pans, and the exterior of the coupling is given a treatment similar to that for the pipe.

Any ditch for 66-in. pipe, with 4 ft. of cover, adds up to a lot of backfilling. But in some sections the ditch is 18 ft. deep, which makes a big difference. The meticulous care required in backfilling is a natural continuation of that prescribed for transporting the pipe and placing each section in its numbered sequence at the approximate location for lowering into the trench.

Only selected material, free from rocks or lumps that might damage the wrapping, is placed next to the pipe. Up to the spring line it is settled with water or tamped. Above that line extreme care is taken to prevent injury to the wrapping, and the engineer may ask for tamping, rolling, or puddling with water. Water for puddling is provided, free, by the city. From October 1st to June 1st, the period of low water in this area, no water may be used except by permission of the County Roadmaster. During backfilling the pipe must be kept under full pressure.

A number of special provisions govern the work. One is the necessity for a special permit for hauling the pipe, because of its unusual length, diameter, and weight. One of the problems involved the special truck provided for this hauling by Consolidated Freightways, of Portland. To resist any thrust which may develop at elbows and turns, the engineer requires a mass of concrete placed around the beginning of the elbow or turn.

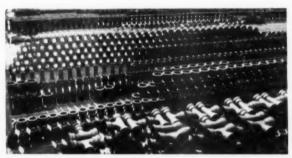
Quantities give a good idea of the work being done. There are 10 miles of 66-in. pipe made of $\frac{3}{8}$ -in. plate from the headworks to Lusteds, and 15.5 miles of 56-in. pipe made of $\frac{5}{16}$ -in. plate from there to the reservoirs. Also there are short lengths of 60 and 52-in. pipe. All of this is connected with Dresser

couplings. There are 25 gate valves. 60, 30, and 6-inch; one 6-in. air valve; and 24 blowoff type gate valves. Some small cast iron pipe, 900 ft., in all, is used, and a number of corrugated pipe culverts are installed. One Venturi meter is required on each end of the line, both with automatic registering apparatus. These were supplied by Simplex Valve & Meter Company.

Personnel

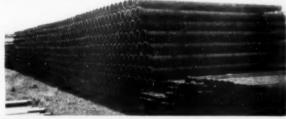
For the city the central figure is always Ben R. Morrow, Engineer and General Manager of the Bureau of Water Works, Department of Public Utilities. In the preparation of plans for the new conduit he had the active support of his chief, Fred L. Peterson, then Commissioner, who moved up to the Mayor's job on January 1st. Ben Morrow is one of the ablest and most esteemed members of the engineering fraternity, and he has served the City of Portland for many constructive years.

Fred M. Randlett is consulting engineer; H. Kenneth Anderson, Principal Civil Engineer, runs the job. Assisting him are Syd Benedict,



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"Leo" Ritter

(Continued from page 18)

bidder on a state road project within the borders of the county. This action was unprecedented in Florida and presumably in other states, as well.

Soils — Your writer her been doing a lot of thinking about soils and soil engineering in recent months, a portion of which is reflected in the series of articles beginning in this issue. It seems to me that soil mechanics, which used to be a

sort of "mystery science", is becoming more and more usable all the
time. It is still not possible to solve
soil problems on anything resembling an arbitrary or "handbook"
basis, but soil engineering is no
longer a highly theoretical subject
with little relation to practical problems. The material contained in the
articles which begin in this issue is
basic in nature, intended to provide
working tools for an understanding
of soils and soil action. We hope to
follow the basic series with additional articles on specific problems.

Patching — If you missed the article on patching by George Martin in the June issue of *Public Works*, we suggest you go back and find it. It's a classic.

New England Turnpikes -The number of toll highways continues to grow and grow. Construction is under way, or nearly so, on the 45-mile extension of the Maine Turnpike from Portland to Augusta and on the first section of the Central New Hampshire Turnpike, Local opposition to the proposed location and subsequent matters have delayed the start of construction on the New Massachusetts Cross-State Turnpike from Westboro into Boston. Work on the new Connecticut Expressway which will cross the state from Rhode Island to New York is expected to begin next spring.

Hampton Roads - Plans are well underway for the start of construction next year on the tremendous Hampton Roads Bridge-Tunnel in Tidewater, Virginia. The project will link Norfolk with Phoebus, Hampton and Newport News. Total cost of the project will be in the neighborhood of \$80 million. The vehicular tube portion of the project will be 7200 feet long, ranking it fourth in length behind the Brooklyn-Battery, Holland and Lincoln Tunnels, all in metropolitan New York. Construction will be financed by tolls. Howard, Needles, Tammen and Bergendoff, one of the outstanding consulting engineering groups in the country, is working with the Department of Highways on the project.

Maintenance in the Summer —Why must many maintenance operations be done in the summer when they interfere with vacation and recreation travel? Obviously, the main reason in many sections of the country is weather, but does your traveling public know and appreciate



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this? Seems to us that getting this message across to the public is an important public relations job which would make things a lot more pleasant all the way around. Selling the highway program must be a continuing, persistent, day-to-day effort. Are you doing all you can to get the message across?

From Here and There - An unusual, beautiful and controversial bridge is the so-called "Butterfly Bridge" which has been proposed as a crossing of the southern end of San Francisco Bay. Originated by Frank Flovd Wright, it incorporates twin concrete arches which are curved in a horizontal plane. A national conference of county engineers and officials will be held September 24-25 in Dell View Hotel on Lake Delton in Wisconsin: it is sponsored by the County and Local Roads Division of the American Road Builders' Association. The Senate Appropriation Committee has ordered an investigation of the use of the movie "Road Test One-Maryland", produced by the Bureau of Public Roads, by the railroads to stir up support for legislative attacks on truck competition. Fiftytwo engineering college students are participating in the summer employment program sponsored by the Associated Pennsylvania Contractors. More than 100 highway engineers from 16 states attended the conference on modern highways held at M.I.T. late in June. Harry Barnes. formerly traffic engineer in Denver, has taken a similar post in Baltimore, where he reportedly will be the highest paid traffic engineer in the country.

"Doc" Symons

(Continued from page 14)

a department store, but to do so it was necessary to find something to replace the girl in the system-. "And", said Lew, "Finding something to replace a girl in this world isn't easy!"



At one session I got to gabbing with "Sherm" Chase of Metcalf and Eddy, "Ed" Showell of DuPont and "Bill" Brush, AWWA perennial Treasurer. "Ed" said he attended his first convention in 1912 and it was the AWWA meeting in Philadelphia. "Sherm" Chase's first convention was the International Congress of Hygiene and Demography, also in 1912.-Incidentally, Ed qualified for Life Membership in AWWA, but he thinks his records have been lost since he never received the L. M.



Swedefinition - overheard at the convention - "A handicap is an arithmetical remedy for some brands of golf"-Anon.



Among the memorable evenings of room hopping were encounters with John Musser of Flint, Mich., who carries eight pipes or so, which he smokes in rotation.

And I had a delightful half hour with Dr. J. J. McCarthy, Chemist of the Racine, Wis., Water Dept. Some time I'm going to Racine and spend a day getting material for a whole column on McCarthy stories like the time the Associated Press said he had developed a formula for keeping fish alive for 100 years or the time a doctor gave him an injection-but I'll save that story. . .



News Notes from Brushy Bend

Among the rump sessions I attended was the Wisconsin Section breakfast at which Leon Smith was the guest of honor and received a bound volume of letters sent him when he completed 25 years as Secv. of the Wisconsin Section last autumn. Hosts at the breakfast were the men from Mueller Co., and Bob Morse. Sales Mgr., was a bit embarrassed to arrive late-but then lots of people were oversleeping slightly.

And of course my favorite club met: The Society of Council Bluffers, that intrepid band who journeved by private car to San Francisco in 1947. For the ensuing year Dan Saunders (Permutit, Vice Pres.) was elected president of the S. C. B.'s and Attmore (W & T) Griffin was elected Vice Pres. No breakfast was held this year because of lack of facilities. A committee was appointed to plan for the trip to Seattle next year. The committee includes Harry (Permutit) Boehner, Ed (Du Pont) Showell, Wendell (Akron) La Due, Reg (Hydrotite) Haves, and Sam (Elizabeth, N. J.) Newkirk. This report constitutes my minutes of the meeting as secretary of the group.

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Well, that pretty well does the story of Grand Rapids, except for a few items, and next month being September I'm going to preview the Miami Convention of the Federation. V. T. Y .- "Doc" Symons

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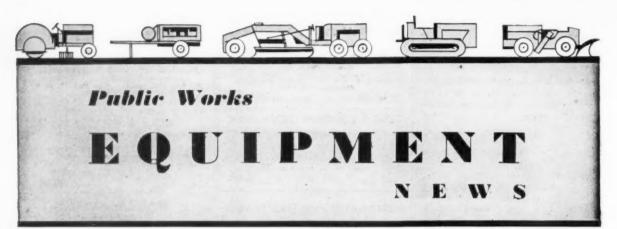
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Use coupon on page 32; circle No. 8-1



Small and Mobile Trencher With 4-Speed Transmission

This is a small and compact trencher which is said to have exceptional maneuverability. It is designed for use in crowded city and suburban areas. For each of the four wheel speeds there are 12 crawler speeds thus providing digging speed combinations from 0.45 to 34.6 feet per minute. Complete information may be obtained from Cleveland Trencher Company, 20100 St. Clair Ave., Cleveland 17, Ohio.

Use coupon on page 32; circle No. 8-2

Service Tapping Saddle Combines Three Elements

Three sealing elements are said to be combined in the new Baker saddle. There is a seal between the saddle and the pipe; another between the gasket and the pipe; and a third between the saddle and the pipe. Only moderate tightening is required. Works on rough or smooth pipe. Made for 1 to 24-in. pipe; and for taps ½ to 4 in. R. H. Baker & Co., 2070 E. Slauson Ave., Huntington Park, Calif.

Use coupon on page 32; circle No. 8-3

Motor Graders with Power-Shiftable Moldboard

The addition of a power-shiftable moldboard to its motor graders has been announced by J. D. Adams Mfg. Co., Indianapolis, Ind. The shift is made by hydraulic power through a convenient control in the operator's cab; a shift of 26½ ins. to either right or left of center position can be made in about 10 seconds, enabling the operator with very little effort and time to get extreme blade positions for cutting



Power-Shiftable moldboard.

high banks; low flat backslopes; and wide reaches outside the line of wheels for shoulder finishing. Write to the manufacturer for details.

Use coupon on page 32; circle No. 8-4



Salt and chip spreader.

Hi-way Multi-Purpose Material Spreader

This machine has been designed for one-man operation in the spreading of pelletized calcium chloride, rock salt, sand, chips, and stone, gravel or slag up to $1\frac{1}{2}$ inches in size. The feed roll is driven from the truck drive shaft. It spreads material uniformly 7 feet 6 inches wide, mounts on any standard dump body, replacing the tail gate. Data on Model J from Highway Equipment Company, Cedar Rapids, Iowa.

Use coupen on page 32; circle No. 8-5

Plastic Pipe Can be Armored After Installation

Ampcolite plastic pipe is made by Atlas in sizes up to 6-inch from high impact styrene, and in 10 and 20-ft. lengths. Threaded fittings are available to 2-inch. The pipe may also be armored with Plastoloy, which permits higher temperatures and pressures. Armoring can be done by the manufacturer or after the pipe is installed. More data from Atlas Mineral Prod. Co., Mertztown, Pa.

Use coupon on page 32; circle No. 8-6

Improved Batch Type Asphalt Plant Handles to 6000 Lbs.

A new Madsen 4,000-lb. batch capacity asphalt plant is oversize throughout and can be modified to handle up to 6,000 lb. batches. The aggregate is withdrawn from each compartment of the four compartment bin through three openings, one in the center and one at either edge of the bin bottom. This, it is claimed, eliminates segregation. More from Madsen Iron Works, Inc., P. O. Box 589, Huntington Park, California.

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Handy Hydraulic Derrick for Many Jobs

This derrick can be raised to the operating position in less than a minute and spotted in a number of positions even under full load. Rated capacity 2500 lbs. to 6000 lbs., depending on the operating angle of the derrick. Movement is actuated by twin hydraulic cylinders, and power is from a pump driven by a power take-off from the transmission. Complete data in Bulletin 405. McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15, Mo.

Use coupon on page 32; circle No. 8-8



McCabe-Powers derrick.

New Carbide-Tipped Blades for Radial Saws

Low cost carbide-tipped saw blades are now available for use on radial saws. The low cost is possible because the saws are massproduced. It is claimed the new blades last 25 to 100 times as long as standard blades. Tipped with tungsten carbide the blades will cut gritty forms, laminates, plastics, metals and many other abrasive substances. More from Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

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Hydro-Clam Digs 81/2 Ft. Straight Down

A Hydro-Clam has been added to the Shawnee line of equipment. This is available with 36-inch or 24-inch clam shell type buckets. Each half of the bucket can be operated independently. The maximum digging depth is 8½-ft. The unit operates in a 150° arc and will raise 1/3 cu. yd. of material to a dumping height of 7½ ft. Square cornered excavations can be dug. Shawnee Mfg. Co., Inc., 1947 N. Topeka, Topeka, Kans.

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Medium Capacity Portable Central Hot Mix Plant

This central hot mix plant has allelectric drive and portability. Rated capacity is 60 to 80 yards per hour. The plant has two main units: One is the burner, combustion chamber, drier, dust-collector and fan, all mounted on a rubber-tired chassis; the other is the screen, aggregate bins, feeder, mixer elevator and pugmill, also on rubber tires. Total horsepower required is 150. Pioneer Engrg. Works, 1515 Central Ave., Minneapolis, Minn.

Use coupon on page 32; circle No. 8-11

Lawn and Highway Trimmer and Edger Attachment

This is a motorized trimmer for lawns and around shrubbery which can also be used for sidewalks and highways. It has a 7-inch revolving cutting blade and is an attachment for the Hoffco power unit. The mulch resulting from its use is evenly distributed and need not be raked or swept up. Attachment to the power unit is simple and can be done in a few minutes. The trimmer is extremely light in weight, being almost entirely of aluminum;



Hoffco edger attachment.

and it runs several hours on a gallon of gasoline. More from Hoffco, Inc., Richmond, Indiana.

Use coupon on page 32; circle No. 8-12

Light and Compact 210 CFM Trailer Compressor

A new 210 cfm compressor, mounted on a 2-wheel trailer is said to be light and compact. It is 145 ins. long, 62 ins. high and 75 ins. wide. The weight is 3400 lbs. The engine is a 6-cylinder Hercules. A feature of this new compressor is the Davey multi-port valves, which are claimed to increase the amount of air delivered per pound of fuel. More information from Davey Compressor Co., Kent, Ohio.

Use coupon on page 32; circle No. 8-13

Front End Loader Has High Lift and Far Pitch

A new skid-shovel front end loader has been added by Drott for use on the IHC TD-6 tractor. This loader has a %-yd. capacity bucket, a digging-out force of 8500 lbs., and a lifting capacity of 3000 pounds. This unit is in addition to the other Drott loaders, of which there are now four models for IHC, TD-6, TD-9, TD-14A and TD-18A tractors. Drott Mfg. Corp., Milwaukee 8, Wisc.

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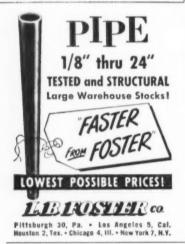
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clearing width from 8 to 10 feet are available. Complete information can be obtained from Frink Sno-Plows. Inc., Clayton, N. Y.

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New Models of Henry Hydraulic Backhoe

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New Henry Backhoe.

correct perpendicular position regardless of terrain. Diamond tread foot plates on the draw bar arms provide greater operator safety. New control levers have been designed to reduce operator fatigue. Complete details available from Henry Mfg. Co., 1700 N. Clay St., Topeka, Kan.

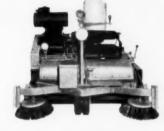
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Hundreds of communities and cities, large and small, have discovered WILSHIRE sweeps faster, cleaner and without dust. It gets in and out of the tight places without bottling up traffic and that makes it ideal for narrow streets and alleys, around safety islands and in congested areas. Write for illustrated brochure.

WILSHIRE POWER SWEEPER COMPANY • 526 W. Chevy Chase Drive • Glendale 4, Calif.

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Burns L-P Gas (commonly known as "Bottled Gas"). Thoroughly tested and proven. Melts approximately 50 lbs. of lead in 9 minutes. Flame can be adjusted to maintain desired temperature. One cylinder of gas will operate unit for many hours. Cylinders are made of armor plate.

Catalog No. 26 on Request.

JOSEPH G. POLLARD CO., Inc. PIPE LINE EQUIPMENT New Hyde Park, N. Y.

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains Economical—Effective

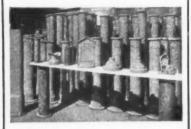
Over 35 Years Of Dependable Performance

MAIN SALES OFFICE 50 CHURCH ST., N.Y.C.

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Yes . . .



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Whether you're in the market for valve boxes, meter boxes, manholes — or special hydrant and fire-box parts such as you see here — you'll find Buffalo Pipe's huge production will give you prompt shipment at reasonable prices. Ask us for Bulletin M 11.

For special quotations, wire, write or phone Dep't H.

BUFFALO PIPE and FOUNDRY CORP.

HEAVY-DUTY ELLIS PIPE CUTTER FOR CUTTING LARGE SIZE PIPE

Drop-Forged Frame and Links Long-Lasting Cutter Wheels

Makes a Hit With Water Works Men



TWO SIZES

No. 01 for 4" to 8" Pipe No. 1 for 4" to 12" Pipe Write for Circular and Price List No. 35PW

ELLIS & FORD MFG. CO.

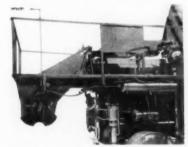
INDEX OF ADVERTISEMENTS

Shrame Assial Survey Corn	116	Hays Process Co.
Abrams Aeriai Survey Carb	42	Mays Process Co.
Abrams Aerial Survey Corp Air Placement Equipment Co. Alabama Pipe Co.	0.2	Hazen & Sawyer
Alabama Pipe Co	126	Healy-Kuff Co
Albright & Friel, Inc.	145	Healy-Ruff Co. Henry Mfg. Co., Heltzel Steel Forn
Norign's Friel, inc. All Purpose Spreader Co. All Purpose Spreader Co. Alvord, Burdick & Howson American Concrete Pressure Pipe Assn. Armo Drainage & Metal Prod. Alda Mineral Products Co. Austin-Western Co.	16-17	Heltzel Steel Forr
All Purpose Spreader Co	23	Highway Equipm
Alvord, Burdick & Howson	145	Hill & Hill
American Concrete Pressure Pipe Assn.	37	Holmes Co., Erne
Armco Drainage & Metal Prod.	121	Hooper, Jr., Will
Atlas Mineral Products Co.	124	Hough Co., Frank
Austin-Western Co. Ayer-McCarel-Clay Co.	. 8 8 9	Holmes Co., Erne Holmes Co., Erne Hooper, Jr., Will Hough Co., Frank Hydraulic Develo
Ayer-McCarel-Clay Co.	138	
		Industrial Materi
		International Ha
Baker, Jr., Michael, Inc.	145	International Ha
Sannister Engineering Co.	145	Irving Subway G
Barber-Greene Co.	43	Italied anomal o
Barker & Wheeler	145	
Baker, Jr., Michael, Inc. Sannister Engineering Co. Sarber-Greene Co. Sarker & Wheeler Slack & Veatch Mackburn-Smith Mfg. Co.	145	Jaeger Machine
Blackburn-Smith Mfg. Co.	56	Jefferson Electric
Blockson Chemical Co. Bogert Assoc., Clinton L. Bowe, Albertson Assoc. Bowerston Shale Co.	30	Jeffrey Mfg. Co. Johns-Manville C Jones, Henry &
Report Acres Clinton I	145	Johns-Manville C
Alberton C.	145	Jones, Henry &
dowe, Albertson Assoc.	145	
dowerston Shale Co.	138	Kennedy Clyde
		Kennedy, Clyde Knowles, Inc., M Koehring Co. Koppers Co. Inc
Brown Co. Brown Engineering Co.	55	Kacheine Co
Brown Engineering Co.	145	Koenring Co.
Buck, Seitert & Jost	145	Koppers Co. Inc
Bucyrus-Erie Co. Buffalo Pipe & Foundry Corp.	15	
Buffalo Pipe & Foundry Corp	152	Lube-Jack Co.
Buffalo-Springfield Roller Co.	19	Leopold, F. B. Lessmann Manuf
Buffalo Steel Div	54	Lessmann Manuf
Buffalo Steel Div. Builders Providence, Inc.	112	Lewis, Harold M
Bush Core	34	
buren Corp.		Lock Joint Pipe (Lozier Co., Wm.
Burgess & Nipple	145	Lozier Co. Wm
Burke, Inc., Ralph H.	145	
Burch Corp. Burgess & Nipple Burke, Inc., Ralph H. Burns & McDonnell Engr. Co. B W Controller Corp.	145	
B W Controller Corp.	136	Master Builders
		McConnaughay, McDonald Mfg. (McWane Cast In
		McDonald Mfg. (
Cotton, Pierce, Streander, Inc.	145	McWane Cast In
Caird, James M	145	Morris Coupling
Calgon, Inc.	49	M & H Valve &
Cotton, Pierce, Streander, Inc. Caird, James M. Calgon, Inc. Camp, Dresser & McKee Capital Engineering Corp. Carlon Products Corp. Carlon Products Corp. Cate Iron Pipe Research Assn. Caterpillar Tractor Co. Centriline Corp. Century Engineering Co.	145	Morris Coupling M & H Valve & Metcalf & Eddy Mueller Co.
Capital Engineering Corp.	145	Mueller Co.
Carlon Products Corp.	65	
Cast Iron Pipe Research Assn.	12 & 13	Market Com
Caternillar Trader Co	4 70 131	Natce Corp. National Clay P
Centriline Corn	116	Marional Clay P
Caterpillar Tractor Co. Centriline Corp. Centrury Engineering Co. Choin Belf Co. Champion Corp. Chester Engineers Chicago Pump Co. Clark-Wilcox Co.	110	National Surety
Century Engineering Co.	110	Natural Rubber
Chain Bell Co	00	Meenah Foundry
Champion Corp.	140	Norton Company
Chester Engineers	145	
Chicago Pump Co.	3	Oshkosh Motor
Clark-Wilcox Co.	48	E 2017 - 3
Classified Ads Cleveland Trencher Co. Climax Engine & Pump Mfg. Co. Clow & Sons, James B. Cole & Sons, Chas. W. Consoer, Townsend & Assoc. Continental Steel Corp.	150	
Cleveland Trencher Co	35	Pacific States Co
Climax Engine & Pump Mfg Co.	22	Pacific Coast Bo
Claus & Sons James B	128	Pacific Flush To
Cala & Cara Chan Mi	140	Polmer & Baker Phelps, Inc., Bo Pirnie Engineers
Cole & Sons, Chas. W.	145	Pheins Inc Bo
Consoer, Townsend & Assoc.	145	Pirnie Engineers
Commonton Stock Corp.		Pitometer Comp
Conveyor Co.	33	Distantional Day A
		Pittsburgh-Des A
		Pollard Co., Inc
Darley & Co., W. S	58	Preload Enginee
Darley & Co., W. S. Darling Valve & Mfg. Co. DeLeuw, Cather & Co. Dempster Brothers, Inc. Dickey Clay Mfg. Co., W. S. Dixon Crucible Ca., Jos. Darr Co.	57	Preload Enginee
DeLeuw, Cather & Co	145	Price Brothers
Demoster Brothers, Inc.	11	
Dickey Clay Mfg. Co. W. S.	138	110 1 1 111 11 T
Diver Crusible Co. los	24	"Quick-Way" To Quinn Wire & I
Day Co	As	Quinn Wire & I
Dorr Co. Dresser Industries, Inc.	43	
Dresser industries, Inc.		Padio Corporati
(See Dresser Mfg. Div.)		Rebert & Co. A
(See Roots-Connersville Blower Con	p.)	Radio Corporati Robert & Co. A Roberts Filter M
Dresser Mfg. Div.	47	Roberts Fifter M
		Rockwell Co., V Roots-Connersvil
		Roots-Connersvil
Elliotte, M. A.	58	Russell & Axon
Ellis & Ford Mfg. Co	152	
		Seamon Motors,
		Segu Co Johy
Fairbanks-Morse & Co.	10	Sherrill Miles C
Fairbanks-Morse & Co. Fairchild Aerial Surveys, Inc.	29	Sherrill, Miles C Skinner Co., M.
Federal Enterprises, Inc.	63	Smith & Gillesp
Cichar Basansah Lab Inc	36	South Bend Fou
Flexible Sewer-Rod Equipment Co.	38	Samle English
riexible sewer-Rod Equipment Co.	40	Stanley Enginee Stilson Assoc.,
Poore Const. Equip. Div.	60	Stilson Assoc.,
Foote Const. Equip. Div. Foster Co., L. B. Foxboro Co. Frink Snow Plows, Inc.	150	
Foxboro Co.	127	Tournet Min C.
Frink Snow Plows, Inc.	42	Tarrant Mfg. C. Texas Vitrified
		Tricklice file
		Trickling Filter
Gannett, Fleming, Corddry &		E.
Carpenter, Inc. Gar Wood Industries, Inc.	145	Union Motel
Gar Wood Industries Inc.	119	Union Metal . U. S. Pipe & Fo
Gilbert Associates, Inc.	145	G. J. ripe a ri
Gilbert Associates, Inc. Gledhill Road Machinery Co. Government Employees Insurance Co.	117	
Covernment Employees Insurance Co.	64	Wallace & Tier
Constant & Manager Insurance Co.	146	Watkins, J. Ste
Greeney & Manson	146	White Co., Day
Green Co., Howard R.	140	Whitman Renu
Greeley & Hanson Green Co., Howard R. Greenlee Bros. & Co.	50	Watkins, J. Ste White Co., Dav Whitman, Requ Wilshire Power
		Wolverine Tub
Marie C. John I	146	Wood Bros. Mi
Harte Co., John J.		Wood Co. R.
Hauck Mfg. Co.	144	Worthington Co
Mayons & Emerson	146	recommington Co

Mays Process Co. Mazen & Sawyer Healy-Ruff Co. Henry Mfg. Co., Inc. Heltzel Steel Form & Iron Co. Highway Equipment Co. Hill & Hill Holmes Co., Ernest Hooper, Jr., William T. Hough Co., Frank G. Hydraulic Development Corp.	56 146 14 48 113 120 146 110 146 51
Industrial Materials Co. International Harvester Co. International Salt Co., Inc. Irving Subway Grating Co., Inc.	138 59 67 18
Jaeger Machine Co. Jefferson Electric Co. Jeffrey Mg. Co. Johns-Manville Corp. Jones, Henry & Williams	153 135 61 68 146
Kennedy, Clyde C. Knowles, Inc., Morris Koehring Co. Koppers Co. Inc.	146 146 140 53
Lube-Jack Co. Leopold, F. B. Lessmann Manufacturing Co. Lewis, Harold M. Link-Bels Co. Lock Joint Pipe Co. Lozier Co., Wm. S.	150 154 129 146 69 155 146
Master Builders Co. McConnauchay, K. E. McDonold Mrg. Co., A. Y. McWane Cast Iron Pipe Co. Morris Couoling and Clamp Co. M. & H. Yalve & Fittings Co. Muctal & Eddy Mueller Co.	2 40 21 143 126 144 146 25
Natce Corp. National Clay Pipe Mfrs., Inc. National Surety Corp. Natural Rubber Bureau Neenah Foundry Co. Norton Company	138 31 44 6 114 39
Oshkosh Motor Truck Inc.	46
Pacific States Cast Iron Pipe Co. Pacific Coast Borax Company Pacific Flush Tank Co. Palmer & Baker, Inc. Phelps, Inc. Boyd E. Pirnie Engineers, Malcolm Pitometer Company Pitrsburgh-Des Moines Steel Co. Pollard Co. Inc., Jos. G. 151 & Pomona Terra-Cotta Co. Preload Engineers Inc. Price Brothers	136 146 146
"Quick-Way" Truck Shovel Co	
Radio Corporation of America Robert & Co. Associates Roberts Filter Mfg. Co. Rockwell Co., W. S. Roats-Connersville Blower Corp. Russell & Axon	52 147 58 50 28 147
Seaman Motors, Inc. Seay Co., Irby Sherrill, Milles O. Skinner Co., M. B. Smith & Gillespie South Bend Foundry Co. Stanley Engineering Co. Stilson Assoc., Alden E.	147 147 14 147
Tarrant Mfg. Co. Texos Vitrified Pipe Co. Trickling Filter Floor Institute	. 153 . 138 . 138
Union Metal U. S. Pipe & Foundry Co.	123
Wallace & Tiernan Co., Inc. Back Watkins, J. Stephen White Co., David Whitman, Requarpt & Assoc. Wilshire Power Sweeper Co. Wilshire Power Sweeper Co. Wolverine Tube Division Wood Bros. Mfn. Co. Wood Co., R. D. Worthington Corp. 26	Cover 147 108 147 151 109 134 139 8 27

Pioneer Asphalt Mixing Plant **Improvements**

Among the improvements on the Pioneer continuous process asphalt mixing plants are: A new type



truck loading hopper to permit discharge of material into trucks with a minimum of segregation; and increased hopper capacities to permit more time for changing trucks without delaying operation. More from Pioneer Engrg. Works, 1515 Central Ave., Minneapolis 15, Minn-

Use coupon on page 32; circle No. 8-21

Costs of Sidewalk and Curb Construction

Recent bids received by Granite Falls, Minn., were as follows: For 4-inch sidewalks 30 cents a sq. ft.; for 6-inch sidewalks 40 cents a sq. ft.; for straight curb and gutter \$1.40 per lin. ft.; and for radial curb and gutter \$1.65.

Illinois Traffic Engineering Conference

The Sixth Annual Illinois Traffic Engineering Conference will be conducted at the campus of the University of Illinois at Urbana on November 3 and 4. Requests for additional information may be addressed to R. K. Newton, Supervisor, Engineering Extension, 7131/2 South Wright Street, Champaign, Illinois.

County Highway Conference

The County and Local Roads Division of ARBA will hold a highway conference at the Dell View Hotel. Lake Delton, Wisconsin, September 24 - 25.

Georgia Water & Sewage School

The 22nd Georgia Water & Sewage School will be held at Georgia Tech, Atlanta, September 23, 24 and 25. You can get more information from N. M. deJarnette, Water Pollution Control, State Department of Health, Atlanta, Ga.

Jaeger's Proven "New Standards" give you 4 days' work in 3



Comparable increases in production are yours with all "new standard" 125 ft. Jaeger compressors. They have been proved-in-use by over 30,000 units

185 ft in the field, yet prices are in every case below those being asked for 250 ft. "old standard" machines. 365 ft.

See your Jaeger distributor or write for Catalog JC-1.

400 Dublin Avenue THE JAEGER MACHINE COMPANY Columbus 16, Ohio

MIXERS . TRUCK MIXERS PAVING MACHINERY

FOR positive ICE AND SNOW CONTROL



THE "SCOTCHMAN"

is BEST because:

1. It SAVES you MONEY The "Scotchman" - method (clear de-icing salts) is 50% cheaper than sanding or cinder-



2. It SAVES you TIME - The "Scotchman" is a FAST spreader - up to 8 times faster.

3. It is specially designed for long, trouble-free use. Simple to operate. Easy to service.

Booths #41 & 42, American Public Works Show, New Orleans, La.

Manufacturing Company 27 Jumel St., Saratoga Springs, N. Y.





Permanent . No corrosion or tuberculation . Equal distribution . Law loss of head • Requires only small sized gravel · No metal in contact with water!

Write today for details

F. B. Leopold Co., Inc. 2413 W. Carson Street Pittsburgh 4, Pa.

TAPAXTakes the BANG out of Manhole Covers

INSTALLING TAPAX-a matter of minutes



Place Tapax

sticky side

down





Replace

Write for Bulletin No. 11

JOSEPH G. POLLARD CO., Inc. **Pipe Line Equipment** NEW HYDE PARK, NEW YORK

Worth Telling

by Arthur K. Akers



* SOUTHEASTERN U.S.A. is still humming. We note these firms expanding there: OLIVER UNITED FILTERS. with THOMAS REEVES in charge, at Asheville, N. C.: KOPPERS COMPANY, Tar Products Division, with B. OTTO WHEELEY, at Birmingham: THOR POWER TOOL COMPANY factory branch in Atlanta: MAR-MON-HERRINGTON COMPANY, with DENZIL COFFEY district manager; while HUBER MANU-FACTURING COMPANY names J. W. BURRESS of Winston-Salem. N. C., and Roanoke, Va., as one of three new southern distributors. ELPHINSTONE. Inc., of Baltimore and FLETCHER EQUIPMENT & SUPPLIES Inc., at New Orleans are the others.

* JAMES D. DALY is now director of sales for the brass and copper tube division of TRIANGLE CON-DUIT & CABLE COMPANY, New Brunswick, N. J.

The CLARK CONTROLLER COM-PANY has bought outright FUL-LER-JOHNSON COMPANY which in turn owns and operates GOOD ROADS MACHINERY CORPORA-TION, Minerva, Ohio.

MANUFACTURING LESSMANN COMPANY, Des Moines, announces ELMER V. MROZEK as sales promotion manager.

* OOOPS, SORRY! Somebody switched the captions under the LESSMANN MFG. COMPANY and KOEHRING COMPANY pietures in our June issue. MR. DOD-SON'S is actually MR. HARTLEIN'S and vice versa. Fortunately, both are handsome men; and we trust they will find this apology handsome.

* BARBER-GREENE releases another 16mm sound-color film, "A Profit for Everyone," featuring in 26 minutes all of the equipment in their Model 840 asphalt plant line. Ask WAYNE D. ADAMSON, Jr., Advertising Manager, Aurora, Ill., for loan-prints to show.

★ UNITED STATES PIPE & FOUNDRY COMPANY is another major southern mover. Their general offices have gone to Birmingham from Burlington, N. J. The SLOSS-SHEFFIELD STEEL & IRON DIVISION of U.S. long at Birmingham, is consolidated with the office there. The Philadelphia sales office has moved to, and been consolidated with, the Eastern sales office at Burlington.

★ JOHN W. DINLEY is new assistant advertising manager of WOLVER-INE TUBE DIVISION, at Detroit.

* PORTLAND CEMENT ASSOCIATION news includes CARL D. FRANKS



Mr. Kennedy



elected president with G. DONALD KENNEDY succeeding him as executive vice president.

★ CATERPILLAR TRACTOR expansion is reflected in designation of a General Offices group and a Peoria Plant group, to operate as separate and distinct units, in East Peoria.

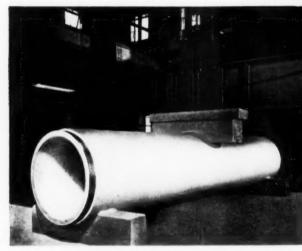
AIR PLACEMENT EQUIPMENT COMPANY, Kansas City, has formed an affiliate, AIRPLACO MANU-FACTURING COMPANY, RALPH CRONEMEYER, president, to manufacture pneumatic and construction machinery for air placement of con-

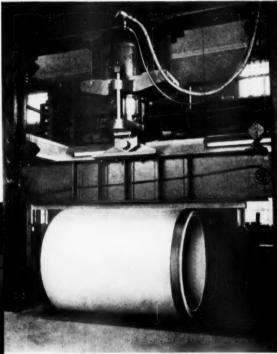
* LEFT OVER FROM WORLD WAR I. A Georgia colored boy aimed to be a hero. His first day in the trenches he leaped on the parapet, calling loudly, "I craves war! Bring on de war!" Instantly a shell hit close by. Four miles and four minutes later our rear-bound hero slowed to 50 mph. "Boy," he panted. "I got one thing to say for dem Germansthey sure gives you service!"

test after test assures the best

™ LOCK JOINT

CONCRETE PRESSURE PIPE





Three edge bearing test in 300,000 pound capacity testing machine.

Determining a pipe's beam strength in 300,000 pound capacity testing machine.

Do you have conclusive proof of the fundamental characteristics of the pipe you intend using in your next water works project? Are you certain of its advantages? Do you recognize its limitations?

In Lock Joint's laboratory at Wharton, N. J. all guess work has been eliminated. Here, Lock Joint Pipes of all types and designs are tested to determine the exact extent of their ability to withstand back loads, beam loads and internal pressures. The most efficient modern equipment in the hands of highly trained personnel is used to give a tangible, practical demonstration of the high quality built into every type of Lock Joint Pipe.

These constant tests of our products are your assurance that, in its field, no finer pressure pipe than Lock Joint can be produced. Built in diameters from 16" upward and designed for any pressure common to water works practice, these pipes will serve you unfailingly for generations.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16" in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subagueous Lines

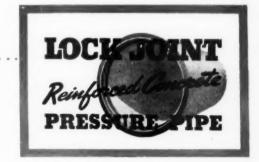
LOCK JOINT PIPE COMPANY

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

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STRIKE BACK.

ODORS!

Odors reduce the efficiency and availability of sewage plant personnel-usually mean septic sewage-and cause complaints by nearby residents.

Strike back effectively and economically at this sewage plant nuisance with a dependable W&T Chlorinator. Chlorination kills the bacteria which cause odors.

Don't suffer through the rest of the season. See your W&T Representative now.

Visible Vacuum Operation

A glance shows that the unit is operating properly.

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Percentage accuracy of feed same throughout range of chlorinator.

Rugged construction

Built to withstand the corrosive atmosphere of sewage plants.

Controls available to fit any plant

Methods of chlorinator control include manual, semi-automatic, rate, program and fully automatic.

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